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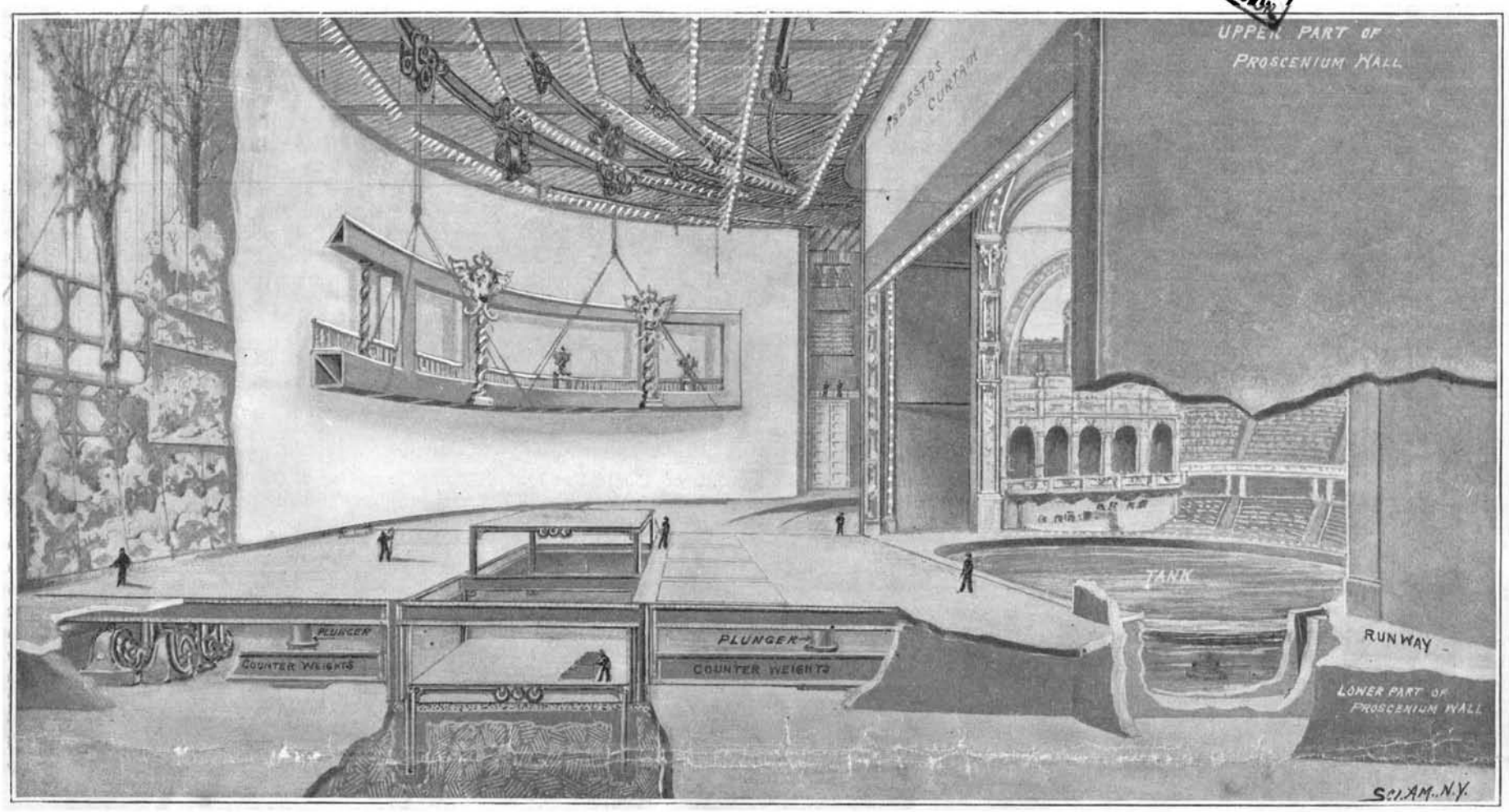
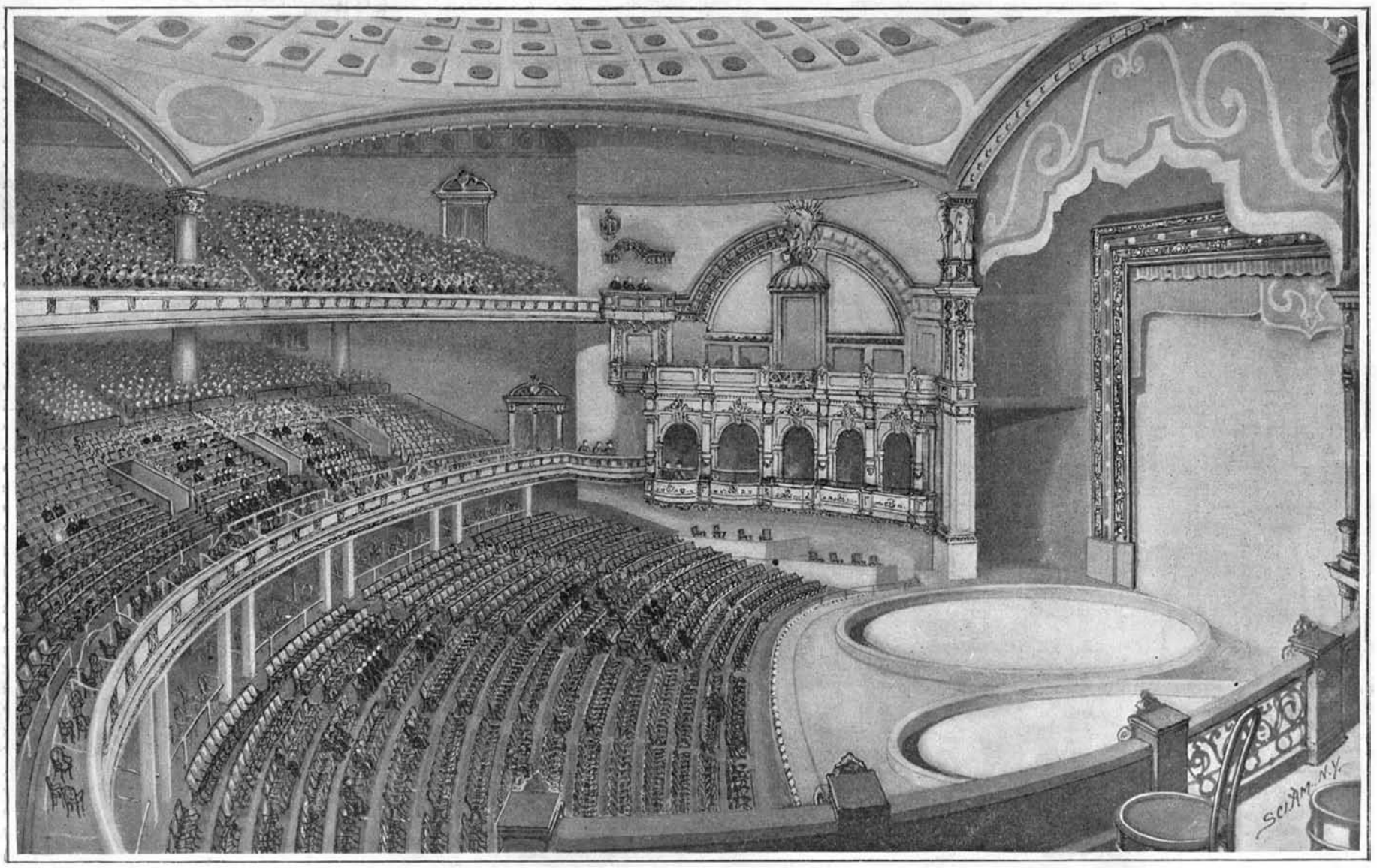


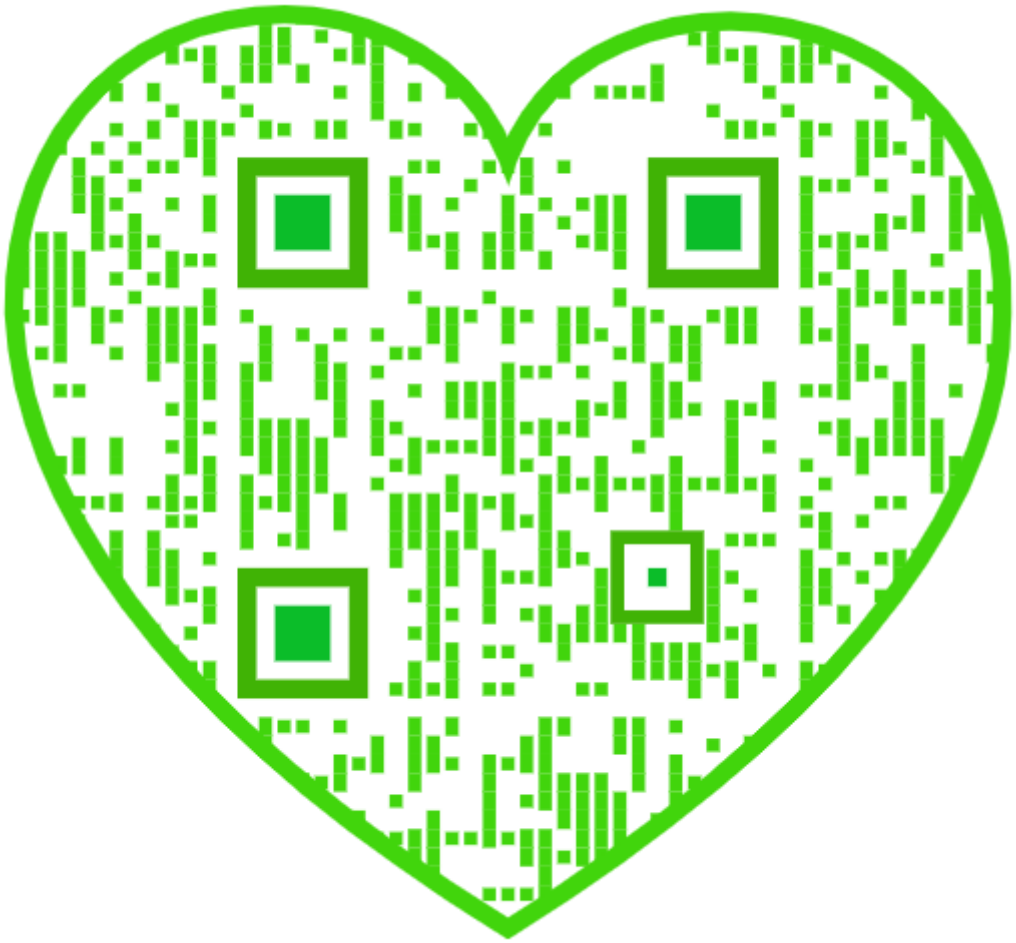
Showing the front movable "apron" over the tank and the main stage, with the hydraulic rams by which they are raised and lowered; the traps in the main stage, and runways by which processions, etc., enter and leave the stage.

Sectional View of the Stage.



General view, showing the auditorium, the front "apron" (stage) forward of the curtain, and the proscenium arch. The apron, which is here shown with two 42-foot circus rings in position, is carried on hydraulic plungers. Below it is a tank of water measuring 60 by 100 feet. When aquatic performances are to be given, the apron is lowered bodily to the bottom of the tank. Behind the curtain is a movable stage measuring 50 by 100 feet.

MECHANICAL FEATURES OF THE NEW YORK HIPPODROME.—[See page 241.]



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NEW YORK, SATURDAY, MARCH 25, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

JAPAN'S LOSSES ON THE SEA.

As the result of the most successful and artistic way in which the Japanese government has managed to conceal the exact extent of its naval losses and damage, it is difficult to say with any certainty just what these amount to. It is claimed by the Russian government that altogether half a dozen battleships and cruisers have been lost beyond recovery, and the indications are that this estimate is not too large. It is known that the battleship "Hatsuse" was sunk by a mine ten miles off Port Arthur, in deep water from which she cannot be recovered. There also appeared a few weeks ago, in the dispatches from Tokio, an acknowledgment, which was said to be official, that the battleship "Yashima" was struck by a mine off Dalny last summer and lost. Subsequently there has been some contradiction of this report; although the consensus of opinion to-day is, that she too has been wrecked beyond recovery. The Japanese also acknowledge the loss of the protected cruisers "Yoshino" and "Miyako," and the cruiser "Sai-Yen," formerly the Chinese "Tsi-Yuen," and also the "Hei-Yen," another old coast-defense vessel captured from the Chinese, and the gunboat "Kaimon." These, with the exception of the "Yoshino," which was sunk by collision, all fell victims to the deadly mine. The "Chiyoda" was also struck by a mine. It is claimed by the Russians also (and their estimates of naval damage have generally been since verified) that they have altogether, in the course of the war, damaged or sunk sixteen destroyers and torpedo boats. It is significant that one of the eight armored cruisers of the Japanese has not been mentioned for several months in the dispatches, and it is possible Japan is short of the services of one of these vessels. If this is the case, she can now put in the fighting line four battleships and seven armored cruisers of modern and thoroughly up-to-date construction. Against these Russia can put in her first fighting line four very powerful and well-protected battleships of the "Borodino" type, and two older battleships of doubtful value. These vessels form the principal elements of the Baltic fleet. If repairs have been completed on the armored cruisers "Rossia" and "Gromoboi," now at Vladivostock, these vessels may also be counted in; but they will only be available in the event, either that they can escape from Vladivostock and effect a junction with Rojestvensky's ships, or that the Baltic fleet can reach Vladivostock, before the encounter with Togo's fleet takes place. Meanwhile the Japanese admiral has been reported as passing Singapore with a fleet of twenty-one vessels.

A SEA-LEVEL CANAL AT PANAMA.

A distinguished European engineer, after visiting this country to study the secrets of our industrial success, stated, as the result of his observations, that we owed much of our rapid advancement to the free use which we make of the scrap heap. The observation was that of a shrewd observer; for there can be no doubt that the readiness of the American people to sacrifice machinery, plant, and buildings, just as soon as it is realized that the substitution of later and more improved methods and construction will more than pay for the cost of making the change, has been one of the most fruitful sources of our industrial progress. There are some fields of work, however, and notably those which fall within the province of the civil engineer, to which the above considerations do not, or should not, apply. Both the common dictates of prudence and the dearly-bought experience of the past, teach us that, in the construction of railways, canals, reservoirs, and all heavy and costly works of a similar character, everything should be planned with a strict regard for the demands, not merely of the immediate future, but of that remoter time, of which, in the construction of works of less importance, no thought would be taken. There are some national works which, like the national constitution, should be planned for all time.

These considerations apply with special emphasis to that great engineering problem to which the United States has committed itself in the construction of a ship canal across the Isthmus of Panama. From whatever standpoint we look at it, the conviction is brought home to every thoughtful mind that this is destined to become in due time, and rather sooner than later, the most important artificial waterway in the world. Therefore, it should be constructed with a view to rendering it available for all the shipping and for any size of vessel, that may wish to pass through; moreover, it should be so constructed as to offer the minimum of risk and the speediest transit possible, to the great and ever-increasing tonnage that will make use of it.

There can be little doubt that it is considerations of this nature that have produced the growing sentiment among engineers and in Congress, in favor of the construction of a sea-level canal rather than of one with locks and a summit level; and the feeling has been strengthened by the opportune report recently made to the Isthmian Canal Commission by their Engineering Committee, in which it is shown that recent developments at the Isthmus indicate that a sea-level canal can be constructed in from ten to twelve years, at a cost not to exceed $230,500,000. This is only $52,462,000 more than the estimated cost of a canal with locks, with a summit level of 60 feet above mean tide. Moreover, the sea-level canal would take only from two to four years longer to construct; if completed on the generous dimensions proposed by the engineers, it would be sufficient to accommodate the largest ships that would be built for many years to come; and it would present the great advantage that deepening and widening of the canal could be carried on at any time without the least interference with navigation.

The recommendations of the committee call for a sea-level canal, with a bottom width of 150 feet and a minimum depth of water throughout of 35 feet, with twin tidal locks at Miraflores to accommodate the rise and fall of the tide, the locks to be 100 feet in width and 1,000 feet in length. The total estimated cost of $230,500,000 includes an allowance for administration, engineering sanitation, and various contingencies amounting to $38,450,000; but makes no allowance for interest during construction, expense of zone government, and collateral expenses. It is recommended that the Chagres River be controlled by a dam at Gamboa built to a height to crest of 200 feet, the surplus waters of the lake thus created to be carried off to the sea by means of tunnels through the divide. The work on the foundations of the dam will require from one to one and a half years, and in the opinion of the committee, it should be begun at once.

It is satisfactory to know that the estimate of cost is based upon the probable cost of excavation of the Culebra cut, which in a sea-level canal would constitute the main obstacle to be overcome. For the cost of operation in the cut has been accurately determined in the work of excavation with American machinery and methods that has been carried on by the government for several months past. It has been found that the entire excavation can be done at a cost of fifty cents a cubic yard. The former Isthmian Canal Commission estimated this cost at eighty cents a yard. This reduction amounts to a total for the whole work of $15,000,000; and it is this great reduction in a class of work which will constitute by far the largest element of cost in the sea-level canal, that is given by the committee as a justification of the larger scheme. Furthermore, it is pointed out that the results thus far obtained in the Culebra cut have been reached under disadvantageous conditions of organization of both plant and force; and the Chief Engineer estimates that with one hundred steam shovels installed, and with a complete system of tracks to serve them, a yearly record of 30,000,000 cubic yards of excavation may be reached, without requiring a greater output per steam shovel or greater speed in working than has already been attained.

Finally, by way of emphasizing the necessity for building the canal with ample dimensions, that may be readily increased at any time in the future without interfering with navigation, we may mention that there are two transatlantic steamers now under construction, which are to have a draft of 35 feet and a total length of just under 800 feet. Twelve years from this time, when the canal is opened, there will be vessels afloat exceeding even these dimensions.

THE TIDES AT COLON AND PANAMA.

The great difference in the amount of rise and fall of the tides at the two ends of the Panama Canal has been a source of considerable surprise to many persons unacquainted with the facts.

At Colon, the Caribbean terminus, the mean range is 0.6 foot, while at Panama, the Pacific terminus, it is 12.6 feet. This is the official record of the Coast and Geodetic Survey. Rear Admiral Chester, of the U. S. navy, who has spent several years on and near the Isthmus, gives the difference of tide as 8 feet and 32 feet on the Atlantic and Pacific sides, respectively. Gen. Peter C. Haines, U. S. army, in a recently published article on the Panama Canal, says the rise and fall of tide at Panama, or the Pacific side, is 20 feet, and at Colon, the Atlantic side, one foot; so that while the mean level of the two oceans is precisely the same, the level at Panama is 10 feet higher at high tide and 10 feet lower at low tide, than it is at Colon; and of course this occurs twice every day.

It is here proposed to briefly state how this condition is brought about.

In the first place, it may be said that the tidal oscillation, whose period is one day, will not be considered. The extreme fortnightly range of this oscillation is about 1.2 feet at either Colon or Panama. We are here concerned with the ordinary semi-daily tides.

The semi-daily tides along the outer coast of the United States from Martha's Vineyard to Cape Canaveral, Florida, occur at nearly one and the same time. The average range of tide generally lies between 3 and 7 feet for this coast. The simultaneous occurrence of the tide at once suggests the existence of an area containing a stationary wave, and extending southeasterly from the United States toward the opening between eastern Brazil and western Africa. By the term "stationary wave" is meant an oscillation, or periodic movement, of a body of water, as when it is high water at one point, it is then high water over a large portion of the body, and correspondingly low water over the remaining portion. The lines bounding the middle portion of the area between the limits of greatest rise and fall are called nodal lines. Thus, near such lines the rise and fall is slight, but the horizontal movement across them is considerable. As a simple, practical illustration, let a basin which is partly filled with water be oscillated vertically; the water will rise on one side of the basin as it falls on the other, while in the middle portion of the body of water there will be scarcely any vertical movement. Now, applying this to the case in hand, it will be seen that on the line before referred to as extending southeasterly from the Atlantic coast of the United States, when it is high water on the said coast, it will be low water in the region northeast of Brazil, while halfway between these limits there will be a stationary wave. That is to say, at halfway points, or along the middle of the line referred to, there will be little rise and fall, and hence small ranges of tide.

Observation shows that at St. Thomas Island, a little east of Porto Rico, the range is only 0.3 foot, and the range is small for all of the Leeward Islands. Thus we are enabled to say with considerable certainty that a stationary wave exists extending southeasterly from the United States, and with its first nodal line ending in the Leeward Islands. This circumstance is very important, because it explains why it is that the Atlantic Ocean tide does not enter the Caribbean Sea with sufficient range to cause a fair-sized derived tide at Colon. The tide at Colon is chiefly due to the tide produced in the Caribbean Sea by the direct action of the tidal forces, and is nearly independent of the tides of the Atlantic. Its range and time of occurrence correspond well with this assumption. If there were a considerable tide along the Lesser Antilles and other adjacent islands, it would find ample space between the islands to enter the Caribbean Sea, and would of course be almost if not equally strong at Colon; but as it is, the Caribbean Sea is left to itself, so to speak, and responds but feebly to the moon's attractive force.

The relatively high tides at Panama are due chiefly to a stationary wave or oscillation contained, for the most part, in a large triangular area which constitutes the whole of the North Pacific Ocean.

It is known that in triangular areas, the angles usually have large ranges of tide. If again, for a simple illustration, one will oscillate vertically a basin of triangular form, partly filled with water, this will be sufficiently demonstrated. Panama lies at one of the grand Pacific angles, the Gulf of Alaska marks another, and the eastern coast of the Philippines marks the third. Moreover, there is a gradual shoaling from the mouth to the head of Panama Bay, and this increases the range somewhat. The conformation of the land, or the curve of the shore line to the southward from Panama, is another element in the case, for it tends to form an angle and a bay favoring the higher rise of tide. The tides along the Pacific coast of Panama and Central America occur at one and the same time, very nearly. This suggests a stationary wave. But the diminution of the range of tide from 12.6 feet at the port of Panama to 1.2 feet at Acapulco, Mexico, gives further evidence of this stationary wave. Other evidence is obtained from different parts of the Pacific Ocean. Thus, in the immense basin of the Pacific, the tides are high at the points or angles of the great triangle before indicated, and slight at other intermediate points or at what are technically denominated nodal lines. Those desiring a further discussion of the subject, should consult the Reports of the Coast and Geodetic Survey for the years 1900 and 1904; but enough has been given here to show in a general way how it happens that the tides at the two termini

of the canal differ so greatly in their amount of rise and fall.

In the maps taken from the survey report for 1904 it is noticeable that the cotidal lines converge or crowd together in the vicinity of the Leeward Islands as in a locality just west of Acapulco, Mexico, which indicates a rapid change in the time of tide across the nodal lines of the stationary waves described above. By cotidal lines, as the term itself indicates, is meant an assemblage of points where tides occur at the same absolute time. The maps also show that the time of tide changes but little in going along the Pacific coast of Central America or in going from the United States to the Bermudas or even to Porto Rico. For the facts upon which this article is based we are indebted to the courtesy of the Coast and Geodetic Survey.

AN ELECTRICAL ANALOGUE FOR RESPIRATION.

Hæmoglobin, the coloring matter of the red corpuscles of the blood, is remarkable for the facility with which it unites with oxygen to form oxyhæmoglobin, which, in turn, parts as easily with the oxygen thus acquired and becomes reduced back to hæmoglobin. It is this property that fits the substance for the part which it plays in the respiration of warm-blooded animals. It absorbs oxygen in the lungs and, after having been distributed through the body in the form of oxyhæmoglobin, gives up the oxygen which it has brought with it. Even outside the body hæmoglobin absorbs oxygen from the air and readily gives it up to reducing agents—for example, to the hydrogen evolved at the cathode of a galvanic cell. It may therefore take the place of manganese dioxide as a depolarizer in a zinc and sal ammoniac battery.

A rod of gas retort carbon is painted with several coats of an aqueous solution of hæmoglobin and immersed, with a rod of zinc, in a solution of sal ammoniac and common salt, in which hæmoglobin is insoluble. The electromotive force remains constant for a short time after the circuit is closed, then falls off suddenly as the last of the oxyhæmoglobin is reduced, but it may be restored to its initial value by leaving the circuit open a while or, more rapidly, by blowing air into the liquid. The cell, therefore, produces energy from the consumption of atmospheric oxygen, as the living body does, through respiration.

The analogy goes even further, for if the cell is placed in an atmosphere containing carbonic oxide it does not recuperate in the manner described above. It is poisoned, and by the same substance that poisons animals under like conditions—the very stable compound carboxyhæmoglobin.

Long experience has proved this peculiar battery to be very suitable for bell-ringing and similar purposes, if it is set in the open air. The cost of maintenance is very small.

THE BRITISH NAVAL PROGRAMME FOR 1905.

BY OUR LONDON CORRESPONDENT.

The serious and far-reaching alteration in the balance of naval power in Europe, caused by the destruction of the Russian Pacific fleet by the Japanese, has manifested itself in the naval estimates of Great Britain for the coming year. So great is this influence, that not only has the amount of money allotted for naval purposes been appreciably reduced, but several war vessels authorized in the 1904 programme have been definitely abandoned, while for the first time in twenty years the personnel of the navy is to be diminished. Such a radical departure from progression on the part of the British government serves to throw the effect produced by the destruction of Russia's navy into significance, since had there been no war in the East, Great Britain would have been compelled to maintain the policy which has been carefully followed each successive year for many years past.

Another fact that has affected the British naval plans is the reorganization of the navy carried out by Sir John Fisher upon his accession to the premier post of the Admiralty. By his scheme all the less valuable and obsolete vessels in the British navy have been eliminated. Over one hundred vessels have been removed by his drastic measure, with the consequence that the navy has been rendered more heterogeneous and efficient, and is now a better fighting force than ever.

The sum estimated to fulfill the requirements of the British navy during the coming year is $166,945,000, as compared with $184,445,000 required for 1904, showing a reduction of $18,500,000. Of this sum $47,830,000 is to be devoted to new construction, representing a decrease of $10,440,000 upon the amount expended for this purpose last year. Of the programme authorized last year, it is intended to abandon the construction of one armored cruiser and a number of destroyers. Exactly how many of the latter it has been decided to forego is not divulged, however.

During the coming year the following vessels are to be laid down—one battleship, four armored cruisers, twelve coastal destroyers, six ocean-going destroyers, and eleven submarines. No details, however, are forthcoming of these new ships. During the past year the present fleet has been augmented by four battleships—"King Edward VII.," "Commonwealth," "Swiftsure," and "Triumph"; one armored cruiser; four third-class cruisers; twelve submarines; nine destroyers; four torpedo boats, and one river gunboat. There are now in course of construction 62 vessels, comprising 8 battleships, 15 armored cruisers, 1 second-class cruiser, 1 third-class cruiser, 8 scouts, 18 destroyers, and 11 submarines.

With regard to the destroyers, in the course of the development of this class of fighting unit, two qualities have successively predominated, namely, speed and sea-keeping power. Their study of the tactical and other questions involved has led the Department to the conclusion that two classes of destroyers are requisite, one especially for ocean-going operations, and the other for use in the narrow seas. The Naval Board has accordingly decided to combine the qualities of speed and sea-keeping power in a special type of ocean-going destroyer which will be expensive, and of which therefore the number must be comparatively few, and to design a new type of coastal destroyer which will be comparatively cheap, and of which consequently a large number can be obtained.

The policy of sending ships to private yards has proved completely successful, and the arrears in the repairs of the fleet have been completely overcome. It is not therefore necessary to provide during the coming year for repairs of any ships in private yards. It is intended to utilize the government yards for the purpose of keeping the present vessels in complete repair rather than to employ them for new constructional work. The building of new vessels has been demonstrated by actual experience to be carried out with greater economy in private than in the government yards, while on the other hand, repairs can be more cheaply effected in the latter than in the former.

It is intended to continue the experiments with oil fuel, but it is now quite certain that oil has firmly become established as part of the fuel in the navy, and every arrangement is being made for its supply, storage, and distribution. In connection with this point, it may be stated that already huge reservoirs are in course of erection at Portsmouth dockyard for the storage of the oil, and suitable apparatus is being installed for the transfer of the latter to the compartments intended for storage in the holds of the battleships with facility and celerity.

During the coming year a large number of heavy guns are to be constructed, to meet the armament requirements of the vessels now in course of erection. These weapons comprise 12-inch 45-caliber and 9.2-inch 50-caliber weapons for the battleships, and 9.2-inch and 7.5-inch 50-caliber guns for the first-class armored cruisers.

Exhaustive experiments have been carried out with night sights, with the result that a good optical sight has been obtained, which is to be adopted in the more important gun mountings. A new type of armor-piercing projectile, from which greater penetration can be obtained, has been satisfactorily tested, and is being introduced for all guns of 6-inch and higher caliber. Improvements in submerged discharges and torpedo rooms are being effected, to enable more rapid loading to be carried out. A new torpedo with increased range and speed has been designed, and severe and prolonged trials are now in progress with it upon the torpedo range at Portland. Searchlights have been improved by the general introduction of automatic lamps. Experiments are also in progress at sea with electrically-controlled projectors.

Another important feature, and one which will commend itself to engineers, is the policy of standardization that has been adopted. By co-operation with the machinery manufacturers it has been found practicable to make almost the whole of the main and auxiliary machinery and boilers fitted in ships of the same class, of similar design and interchangeable. In the six first-class armored cruisers of the "Duke of Edinburgh" class, this principle has been brought into effect, and it is now in process of development for the machinery of ships of the "Lord Nelson" and "Minotaur" types. By dealing with vessels in classes, progress is not retarded by such standardization. Admiralty representatives have been associated with the various sub-committees of the Standards Committee, and Admiralty and commercial practice have been assimilated in many features with benefit to each.

The First Lord of the Admiralty states that the fleet has "never been in more perfect state of repair than it is at the present moment," which is most satisfactory, and is due in no small measure to the rigorous policy of the department during the past two or three years, and the wholesale elimination from the fighting strength of all those vessels which do not coincide with modern naval requirements, and which could only be rendered efficient and up-to-date by the expenditure of large sums of money. It is also intended to inaugurate a policy by which, while fewer ships will be in course of construction simultaneously, the time occupied in such work will be considerably expedited. At the present time the building of a battleship, from the laying down of the keel to its actual commission, varies from 30 to 36 months. This work, however, under the new scheme is to be appreciably accelerated.

SCIENCE NOTES.

An important discovery of a new mineral has been made in Ceylon by Prof. W. R. Dunstan in the course of a mineral survey. The discovery, which has been named thorianite, is richly impregnated with the rare earth thoria, the proportion being approximately 75 per cent. What is of commercial importance, however, is the fact that the mineral is not combined with silica.

In a paper recently read before the Académie des Sciences, M. Victor Cremieu describes a series of researches upon liquid drops suspended in a mass of liquid of the same density, with which they do not mix. The drops are thus free from the action of gravity and their mutual attraction is counterbalanced by the pressure of the liquid. If the distance which separates the drops is considerable with relation to their diameter, the capillary forces are quite negligible. Nevertheless, he observed that the drops approached each other slowly, whatever might be the ratio of their diameter and distance apart. In the present experiments he operated with a mass of liquid kept at a constant temperature and free from all disturbances. The liquid was a mixture of distilled water and alcohol, and the drops were formed of pure olive oil. The mixture, which has the same density as the oil, is placed in a vessel four inches high and six inches in diameter, covered with a glass plate. The oil drops are introduced by means of a capillary tube. The jar is surrounded by a metal cylinder to protect it from radiation from the observer, and the vertical and horizontal movement of the drops is observed by means of slits in the cylinder. It is found that the drop always rises in the liquid, as it is impossible to have an exact equality of the density, and a very slight chemical change also occurs which modifies the initial density. With a single drop, it is found that it always rises in a straight line, starting from any point in the vessel. But with two drops the effect is different. The drops were from one to five millimeters in diameter and placed twenty-five millimeters from the sides. They were one hundred millimeters apart at first. Two hours' readings were made of their position, and it was found that they rise in a slight curve, so as to approach each other. Adding a third drop causes a deviation in that direction, and the latter also rises in a curve. These experiments are difficult to carry out, and only six observations were obtained in two months, but they gave very constant results. The author is now studying the effect of solids suspended in a liquid in the same way.

M. Le Roux has carefully studied low temperatures upon phosphorescence, using liquid air. Some previous researches show that the phosphorescence is weakened or extinguished at low temperatures. In the present case he uses a light blue calcium sulphide whose light varies with the temperature when at about the heat of the human body. He places the sulphide in small sealed tubes and excites them together by magnesium light. When one of the tubes is placed in liquid air the phosphorescence is completely extinguished. On taking out the tube the light returns at the end of a few seconds, and its intensity has a maximum value when the tube comes back to the temperature of the air. It appears somewhat higher than that of the check tube according as the cooled tube has remained more or less in extinction. This is explained at once by the hypothesis that the cooling only suspends the phosphorescence, without destroying it, even partially. The phosphorescence is preserved in the potential form. Therefore when the tube returns to the same temperature as the check tube, it is brighter, since it resumes its former value, while the check tube has already weakened. A second question may be asked. When the body is initially at a temperature where the luminous energy which it acquired would become continually latent, may it acquire such energy in the latent form alone? The experiments show that such is the case. A tube of sulphide, made inactive by placing it for a long time in the dark, was plunged in a bath of liquid air while still deprived of light. The whole was taken into the light and together with a check tube was excited by magnesium light. On bringing it again into the dark room, the immersed tube showed no light, as might be expected, but when taken out of the bath and allowed to heat, it became luminous and brighter than the check tube as before. It is to be remarked that the acquired luminous potential energy has always been the maximum which the light could produce upon the body. The conclusion may be reached that the maximum luminous potential energy which a given light can give to a certain body is independent of the temperature. The temperature factor only has an influence upon the speed of transformation of the potential luminous energy into actual luminous energy.

A weighing machine, said to be the most powerful in the world, is being made in Birmingham. It is capable of registering a load of 220 tons.

A NOVEL PROCESS FOR USING BLUE LIGHT AS AN ANÆSTHETIC.

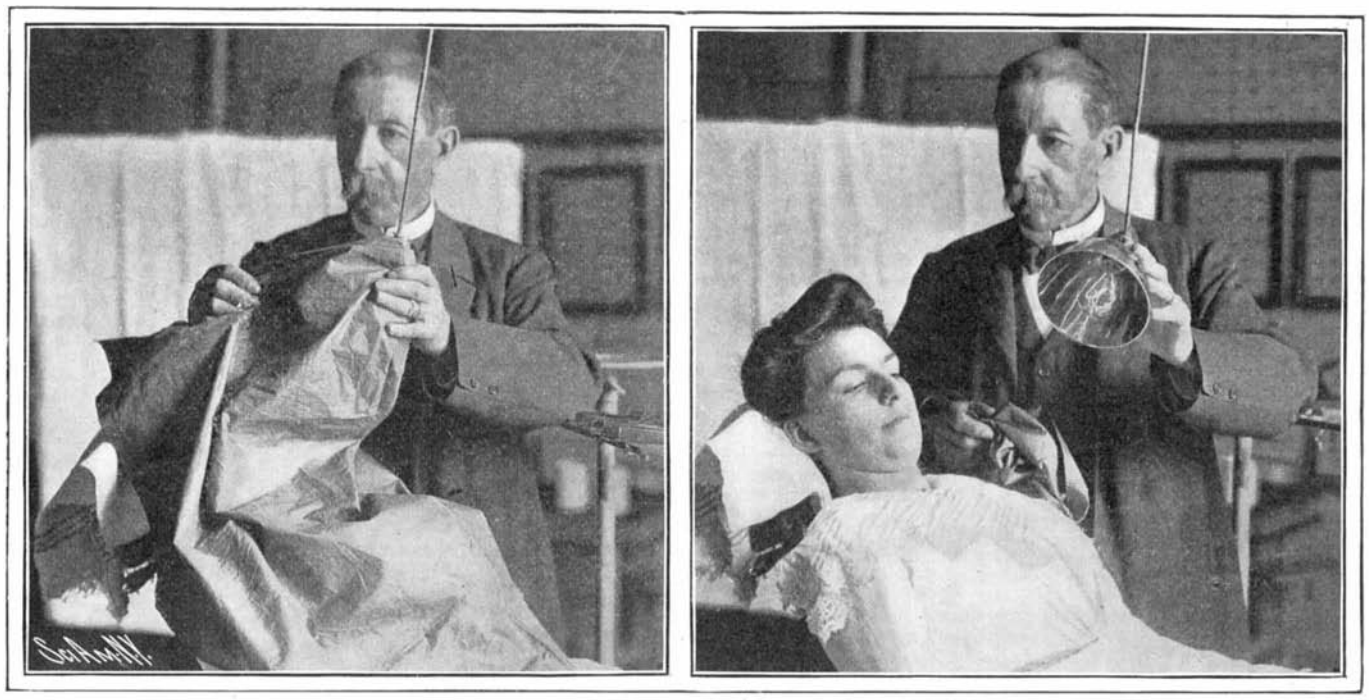
BY DR. ALFRED GRADENWITZ.

Until a few years ago the only method available for rendering the human body insensitive to pain was that of general anæsthesia. The disagreeable and oftentimes highly prejudicial effects of the substance producing insensibility have recently led to the use of local anæsthesia, bearing only on the part directly concerned by the operation. This is rendered insensible by an injection of cocaine or the like, and so highly has this process been improved of late years, that even extensive operations may now be effected by its help, without rendering the patient unconscious.

There are, however, many cases where general anæsthesia cannot be dispensed with, and it is gratifying that even in this direction the modern methods are being more and more developed, any injurious effects being avoided as far as possible by suitable precautions. Ether may be used to advantage instead of chloroform, especially in connection with dental work, but even this anæsthetic is not free from the bad points above referred to. Apart from the danger of giving rise to illness, there is further a rather disagreeable and prejudicial state of excitation previous to insensibility, which, especially with hysterical persons, is a serious drawback to the use of this method.

Prof. C. Redard, of Geneva, Switzerland, has made an interesting observation which he was able to utilize with a view to improving the present methods of anæsthesia.

It is a well-known fact that any external impressions received during the period of somnolence, and even any outside influence during sleep, have great bearing on the dreams attending the latter. Now as, with artificial anæsthesia, the body is left to the influence of any external factors outside of the control of the will to a far higher degree than during ordinary sleep, the possibility of controlling the production of anæsthesia by outside impressions and preventing any disagreeable phenomena that may attend it, should appear plausible to anybody. In fact, it had long been known that external impressions exert a great influence on the period of excitement observed both at the beginning of insensibility, as well as on awakening. Prof. Redard therefore had the idea of utilizing music, when in most cases any disagreeable excitation was found to be replaced by a feeling of well-being. The awakening is also quite free from excitement, there is no nausea, and any disagreeable effects are either avoided or will disappear rapidly, whereas, with ordinary chloroform or ether operations, the feeling of illness is known to last for a very long time. It should be mentioned that the kind of music used at the moment of anæsthesia need not be really artistic; in fact, an ordinary musical box seems to be quite suitable to produce the desired effects. The action of the music should commence at the beginning of anæsthesia, and be kept up to the moment of awaking.



Covering Patient with Blue Veil. Producing Anaesthesia with the Blue Reflector.

THE USE OF BLUE LIGHT AS AN ANÆSTHETIC.

A still more curious process, which will be found described below, was likewise discovered by Prof. Redard and has been used by him for more than three years. This is neither general nor a local anæsthesia, as obtained with anæsthetic substances, insensibility being produced merely by the action of blue light on the nervous center of vision, reacting most likely on the other nervous centers. All the experiments made by the Geneva professor go to show that blue has a decisive anæsthetic action. A great number of patients have been made unconscious by this means, and the results have been presented recently to the Congress of the Swiss Odontological Society, held this year at Lausanne, Switzerland. It should be mentioned that red, yellow, and other rays did not show any result, while green and violet lights, most nearly related to blue light, were found to be also efficient, though to a smaller degree.

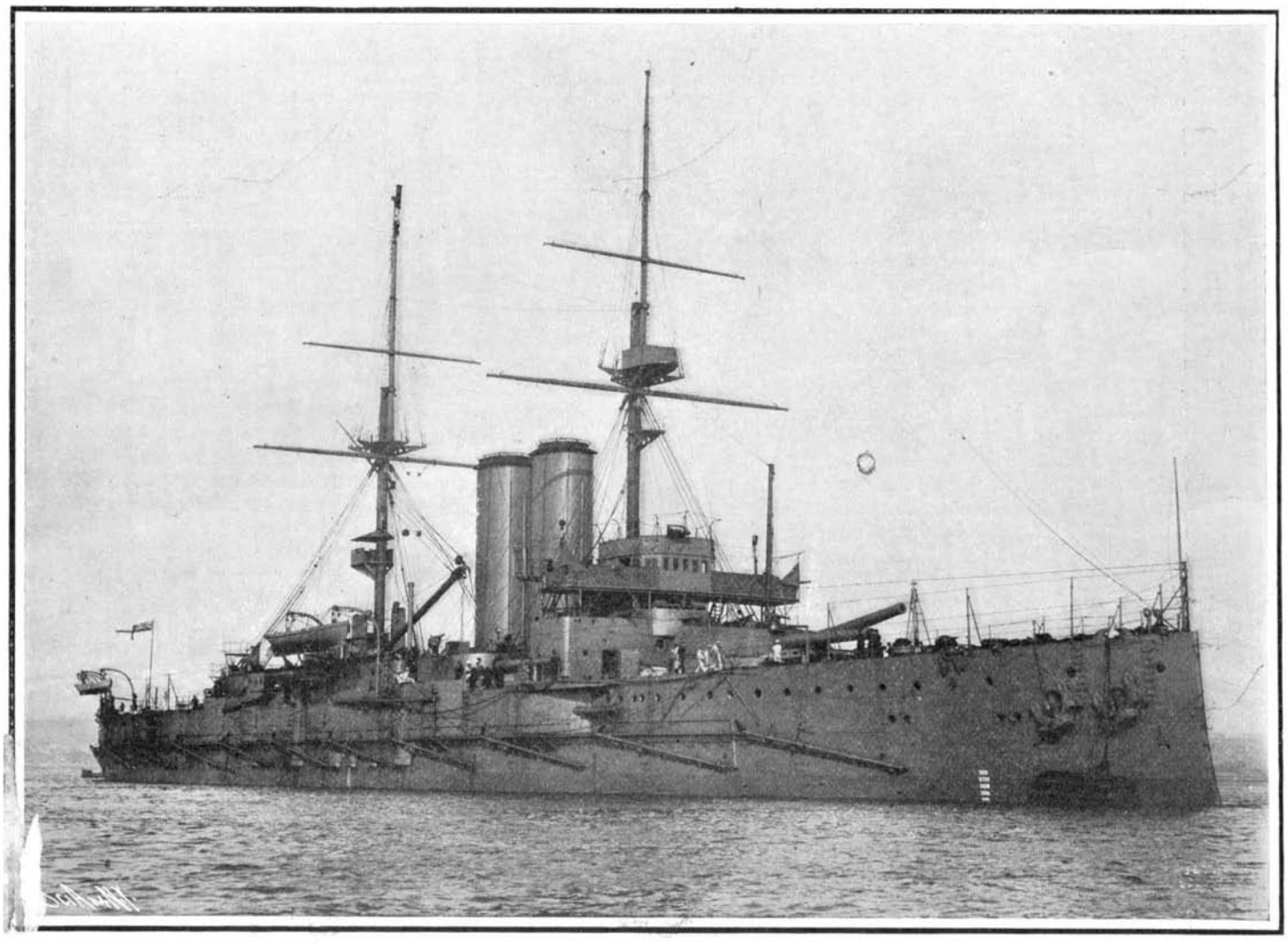
The experimental outfit for this anæsthetic process is a rather simple one, a 16-candle incandescent electric lamp, a nickel-plated reflector, and a blue veil being sufficient. The lamp is fitted with a blue bulb and placed at about 6 inches from the eye, this being the point of convergence of the light rays, while the head of the patient as also the lamp itself is covered with the blue veil to avoid any stray daylight. Two or three minutes' action is sufficient to allow of the extraction of a tooth without any pain.

There is one point which apparently remains doubtful. Prof. Redard does not state whether the person rendered unconscious by his process is in a state of sleep, either natural or hypnotic; but according to the process itself, it would seem as though there were a kind of hypnotic sleep, disappearing, however, without any prejudicial effects, the moment the operation is finished and the action of the blue light discontinued, when the one experimented on seems to awake and states that no pain has been experienced.

THE NEW BRITISH BATTLESHIP "KING EDWARD VII."

The accompanying illustration of the latest type of British battleship, known as the "King Edward" class, should have particular interest for Americans, for the reason that she is the first ship in the British navy to make use of a certain disposition of armor and guns which has long found favor with our own naval constructors. In all British battleships, built during the past two decades, the armament has consisted of four big guns, first of 13½-inch, and later 12-inch caliber, and a secondary battery of 6-inch guns, the secondary battery being disposed amidships in protected casemates. In our navy, commencing with the "Oregon" class, most of the battleships have carried, in addition to the 12-inch and 6-inch guns, a battery of intermediate guns of 8-inch caliber. These were generally disposed in four turrets, placed at the four corners of the secondary 6-inch battery. It is the possession of these 8-inch guns that distinguishes our battleships broadly from those of other navies. As regards the distribution of armor, we have always favored the use of a continuous wall of armor for the

(*Continued on page 242.*)



Displacement, 16,350 tons. **Speed,** 19.04 knots. **Coal supply,** 2,000 tons. **Armament:** Four 12-inch; four 9.2-inch; ten 6-inch; fourteen 3-inch; fourteen 3-pounders. **Armor:** Belt, 9-inch; two decks, 2-inch and 1-inch; side armor of central battery, 8-inch and 7-inch; main turrets, 8-inch and 12-inch; secondary turrets, 7-inch. **Torpedo tubes:** Submerged, four. **Complement,** 800.

THE LATEST BRITISH BATTLESHIP "KING EDWARD VII.," ONE OF A CLASS OF EIGHT SHIPS.

STRIKING SNOW STATUARY.

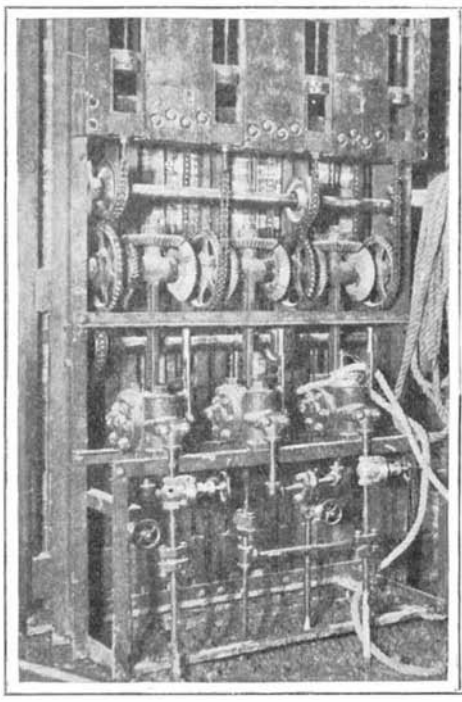
BY DAY ALLEN WILLEY.

In some of the towns of Germany, as well as other portions of northern Europe, snow sculpture has reached a fairly high standard. In the city of Brussels an exhibition is given every winter by the art students, who transform one of the public parks into a natural gallery, and display specimens of their work which are really remarkable. In the little town of Andreasberg, Germany, however, a snow festival, as it is termed, is held yearly, when the villagers vie with each other in the uniqueness and excellence of their work. One of the most remarkable groups which has ever been "done" in Andreasberg is the battle scene which is herewith reproduced. The artilleryman stands in the rear of his piece in the act of discharging it, while just behind it lies the dead body of his brother soldier. A study of the poses of the figures shows they are remarkably realistic, although the proportions and modeling of the gun, including wheels and tube, are a most artistic bit of execution.

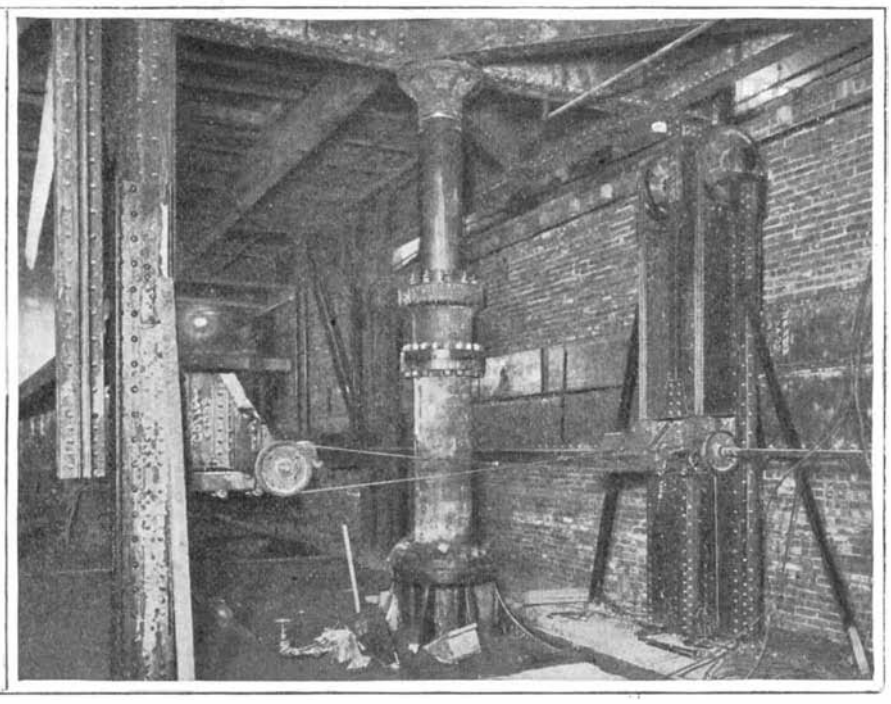
At the winter exhibition given in Brussels, the royal park where it is held sometimes has over a hundred individual and group designs, some of them of heroic size. Entering the park the visitor may pass between rows of snow lions which guard the way on either side. While human figures are common, there are such groups as the training of elephants, showing one huge beast standing on its hind legs or its fore feet on the back of the other, the trainer standing whip in hand. Tigers and horses are frequently represented, while some of the prize-winners have been allegorical designs, such as Charity, depicted by a young woman with children in her arms; Prayer, by an angel kneeling, etc. The well-known painting entitled "Three Jolly Companions" has been faithfully imitated in this material.

The snow sculptors of Europe pride themselves on their ability to fashion their images out of the snow itself, using no other substance except charcoal or some coloring matter to form the eyes and dark shading required. Even the hair and beard are imitated by the clever designers. At Andreasberg the fall of snow in winter is so great that modeling can be done from solid blocks. Such a quantity of "raw material" is required for the Brussels display, however, that the blocks must be made of snow balls. For three or four days visitors are excluded from the park prior to the exhibition, allowing the students to work without interruption. Rolling balls of suitable size they pile them into masses of the proper proportions, packing the cracks and crevices until the surface is entirely smooth. Their tools are exceedingly simple—the thumb and finger-tips, some pointed sticks, and a piece of shingle, or thin board sharpened to an edge. With these they begin work after cutting out a piece here and sharpening off a corner there. If it is a human face, the eyes and nostrils are easily made by gouging the surface at the proper places with the thumb or finger or sharp-pointed stick, then putting a bit of coloring in and above the hole for eyeballs and brows. Two or three motions of the wooden shaver finish the mouth and so the work proceeds. The eye of the workman is generally so true, that he proportions his single statue or group by it alone. To give the figure more of the appearance of sculpture, when the finishing touches have been put on, water is poured over it at night, when the temperature is low enough to freeze it rapidly. If just enough of the liquid is applied, it will give a coating of ice and not injure the work, so that when placed on exhibition it glistens like the bronzes of the ordinary gallery.

If the snowfall is two or three feet in depth, the artists of Andreasberg cut it into cakes of convenient size, and by fitting them together thus form blocks. They utilize the same crude tools, but get a fairly accurate idea of the proper proportions by marking off the surface into squares by means of a string and a pointed stick. Then they trace the outline of the exterior of the figure or features, thus getting a pattern which guides them as they work. When it is stated that the battle scene illustrated was fashioned almost entirely out of a solid mass of snow, an idea of the amount of labor required can be gained. The pattern is of great value, especially in making small figures, since some of the work is extremely delicate, and a mistake of a few inches would entirely alter the proportion. Sometimes it is necessary to fashion a group from several blocks, but most of the designs are modeled entirely from one mass.



Equalizing Valves for Controlling the Pressure of the Plungers.

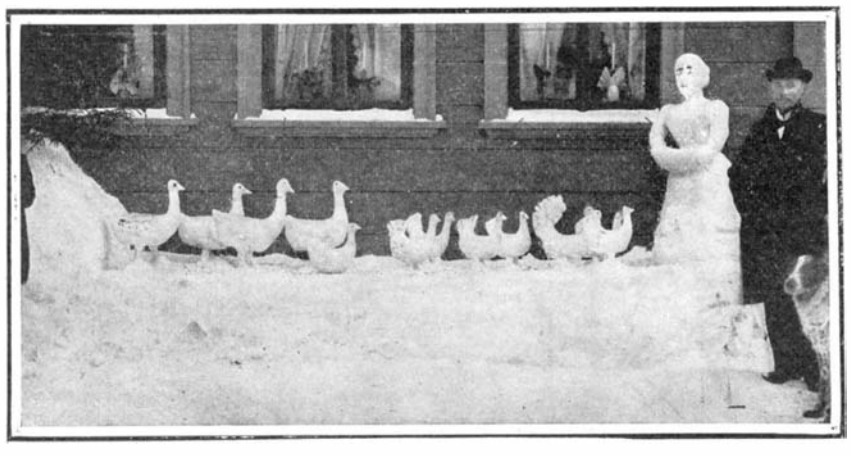


View Beneath Movable Stage, Showing the Counterweights, Guides, Locking Gear, and One of the Four 12-inch Plungers.

STAGE APPLIANCES OF THE NEW HIPPODROME.

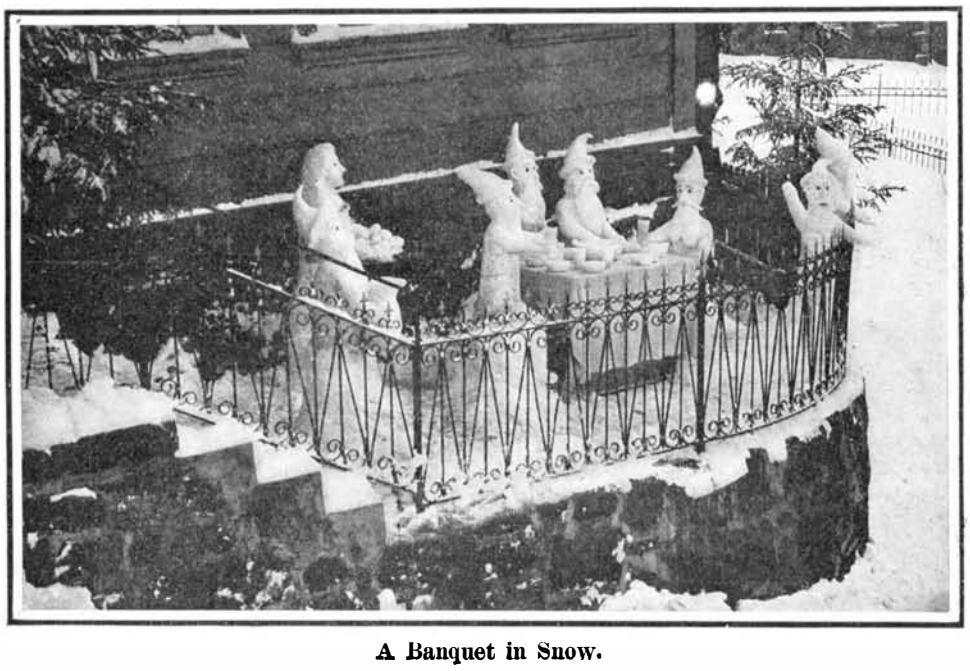
THE NEW YORK HIPPODROME.

The demand for spectacular productions planned on a scale much larger than can be accommodated on the stage of an ordinary theater, was long ago proved by the great popularity of the huge open-air spectacular shows, which for many years have attracted crowds of summer visitors at a certain famous seaside resort within the limits of New York city. In these open-air

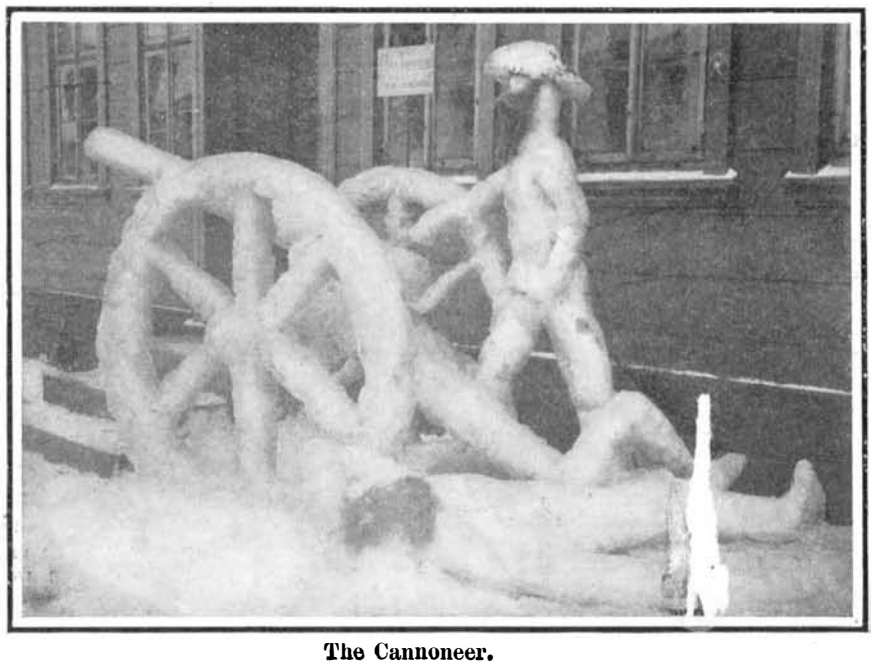


Mealtime in the Poultry Yard.

Little Red Riding Hood.



A Banquet in Snow.



The Cannoneer.

SOME STRIKING STATUES IN SNOW.

productions, much of the excellent effect produced is due to the large sheet of water that fronts and forms part of the stage, and the aquatic and marine effects thereby rendered possible. It would seem, at first thought, that the introduction of a large body of water as part of the "setting" of an indoor stage was, in the nature of things, quite impossible, for the reason that, to secure any adequate effects, the stretch of water would have to be of a size incompatible with the internal dimensions of a theatre or other inclosed place of amusement. Thanks, however, to the enterprise of Messrs. Thompson and Dundy, to whom we are indebted for the plans and data upon which the accompanying illustrations are based, there has been built, in the heart of New York city, a vast amusement house, which will be known by the generic name of Hippodrome, whose dimensions are such as to admit of a stage and a lake of water, large enough for the accommodation of spectacular performances that will rival the outdoor exhibitions to which reference has been made above.

The Hippodrome is a popular and recognized form of public amusement in large cities abroad; but this is the first of the kind to be constructed in the United States, and it also has the distinction of being by far the largest building of its kind in the world. The New York Hippodrome occupies the westerly half of the block bounded by 43d and 44th Streets and Sixth Avenue. There is no playhouse, either here or abroad, that rivals it in size, construction, or equipment. The main façade, which is of impressive and characteristic treatment, has a length of 200 feet, and the building extends for 240 feet on 43d and 44th Streets. It is built of brick, marble, and steel, and it extends to a height of 72 feet on Sixth Avenue and 110 feet at the rear. In its construction every possible precaution was taken to render it perfectly fireproof, and it has more than usual capacity for rapid exits.

To a technical journal, of course, the chief interest of this building centers in the stage, and the entirely novel mechanical arrangements for operating the movable platforms, filling and emptying the tank, raising and lowering the stage, and handling the scenery. But before passing to these features of the building, it will be interesting to mention some of the statistics that tell, better than words, the story of its vast size and capacity. In the first place, the total seating capacity of the Hippodrome is 5,300, which may be compared with the Metropolitan Opera House, 3,400; the Academy of Music, 3,000; and the Broadway Theatre, 1,800. The building is lighted by 25,000 electric lights, and the sunburst in the center of the ceiling alone contains 5,000 electric lights. On the main floor will be fourteen rows of orchestra seats, with accommodations for about 1,100, behind which will be the stalls, which are a common feature of European theatres. Then comes a line of boxes encircling the promenade. Above this is the balcony, seating about 1,600, and over that is the gallery, seating no less than 2,600 persons, or more than most large theatres. The building has thirty-five regular and emergency exits. The roof is carried on four main steel trusses, which are the largest ever placed in a building of this type in the United States. These trusses weigh 50 tons each, and are 115 feet in length by 25 feet at the point of greatest depth. There are also four subordinate trusses, weighing 32½ tons apiece, which are each 110 feet long.

It is in the stage and its accessories, however, that the greatest interest centers. It may be divided for purposes of description into two portions: that which is behind, and that which is in front of the Proscenium Arch. This arch, by the way, is the largest in the world, having a total width of 96 feet and a clear height of 40 feet, and its fire curtain is the biggest piece of asbestos ever woven. The depth of the stage from the extreme front to the back wall is 110 feet, or 50 feet from the back wall to the Proscenium Arch, and 60 feet from the Arch to the extreme front of the stage. The main stage at the rear of the arch measures 50 feet in depth, by 200 feet in width between the side walls. Of this area, the central portion immediately back of the arch, measuring 50 feet in depth by 100 feet in width, is carried on four 12-inch hydraulic rams, and is capable of a vertical movement of 8 feet. The weight of this platform, which is virtually nothing more nor less than a huge elevator, is carried upon four deep plate girders, with the plungers placed at the four intersecting points. This rear stage and the movable apron with their fittings weigh about 230 tons, and the rear stage can be raised from the normal level to a height of 8 feet.

The movable stage is provided with massive counterweights, one line of which will be noticed in the accompanying photograph, showing the under side of the stage and one of the hydraulic plungers. The stage is guided in its vertical movement by steel columns, at the top of which are carried the sheaves for the counterweight cables. Attached to the under side of the stage are vertical guides, which slide within the steel columns. These guides are provided with slots, which are engaged by massive dogs that slide horizontally in the steel columns, and serve to lock the stage at any desired elevation. The dogs are operated in unison by means of lines of countershafting, which are driven by a single electric motor. At each column the countershafting carries a small pinion, which engages a rack on the upper side of the dogs, and when the motor is started, the dogs are thus simultaneously moved into the locking position. The plungers which lift the stage are made to travel at one and the same speed by means of the automatic equalizing valves shown in the accompanying illustration. In the movable stage itself there are seven "traps" provided, each capable of independent operation.

That portion of the stage, 60 feet in depth, which lies forward of the proscenium arch, is known as the apron. It is generally elliptical in form, and measures 48 feet in depth and 92 feet in width. Like the main stage, it is carried on 12-inch hydraulic plungers, with, in this case, a vertical travel of 14 feet. Normally, the movable apron will be at the same level as the main stage. It is large enough to contain two circus rings, each 42 feet in diameter. Beneath the apron is built a huge steel and concrete tank, over 14 feet in depth, and large enough for the whole apron to sink within it. When aquatic performances or naval pageants are to be given, the tank is filled with water, and the movable apron is submerged below the water to the bottom of the tank. Two circular inclined runways lead on each side of the main stage, down to the basement to the animal stalls, and adjacent to the main runway is a narrow runway for the wild beasts. As the runways communicate on a common level, it is possible for processions to make the circuit through the basement and across the stage.

The use of such large quantities of water necessitates an extensive hydraulic plant. The main tank is served by three centrifugal pumps of a combined capacity of 8,000 gallons per minute. Around the back of the stage, at a height of 14 feet, a 12-inch pipe extends for a distance of 180 feet. From this pipe, by means of flexible connections leading to a cataract and fountains, a fine cascade with a fall of 14 feet is formed, with the full capacity of the three centrifugal pumps to maintain it in constant flow. There is also an 8-inch pipe, placed just inside the runway, by means of which a considerable flow of water is produced across the surface of the tank, giving the effect of a river. Flowing water in large volume is also used in the Andersonville battle scene, where a considerable mountain torrent is shown rushing under a bridge of 30-foot span, and flowing with a slower current across the whole length of the tank in the foreground.

The total height from the stage to the gridiron is 80 feet, and this great height well matches the other proportions of the stage. It is here, in connection with the handling of the scenery, that this stage presents some of its most original and striking features. The scenery, in place of being dropped and lifted, is carried, by means of traveling electric hoists, on four separate lines of overhead tracks, which are attached to the gridiron, and curve in concentric semicircles above the stage, and extend into deep side wings known as scene pockets, each of which is of sufficient depth to enable the whole of the one-half of the scenery to be moved within it, clear of the stage. The tracks consist of 12-inch I-beams, upon the lower flange of which run the traveling trolley hoists for handling the set pieces and scenery. There are four double electric hoists and two single hoists. Each hoist is provided with its own electric motor, and has a capacity of from two to three tons. There is a man to each hoist, which he controls by wires reaching to the floor, and by this means the whole of a complicated and heavy scene may be picked up from the stage and carried into the scene pockets, with great rapidity. In each of the side wings of the stage is a series of winding drums designed specially for lifting set pieces. There are in all sixty separate drums, with a lifting capacity of 800 pounds each. The drums are operated from a constantly-rotating shaft by means of friction clutches, and each drum is provided with an automatic catch, which throws the clutch out of gear at the proper moment, when the piece of scenery has been raised to the desired height, or lowered into position. As showing its great capacity, it may be mentioned, in closing, that in one of the scenes as many as six hundred performers will be massed on the stage at one time.

THE NEW BRITISH BATTLESHIP "KING EDWARD VII."

(*Continued from page 240.*)

broadside 6-inch battery, as against the separate armored casemate positions favored by the English and some other powers. In the "King Edward" class, which was the last battleship design brought out by Sir William White, the former chief constructor of the British navy, a new 9.2-inch gun has been introduced, four of these being carried in four single turrets placed at the corners of the central battery. The casemate system of protection is discarded, and the ten 6-inch guns are carried within a central box battery with a continuous wall of armor to protect them. The 9.2-inch guns fire a 380-pound shell, as against a 250-pound shell fired by our 8-inch gun; but we have eight 8-inch as against the "King Edward's" four 9.2-inch guns in the intermediate battery.

The "King Edward" and class—there are eight of these ships altogether—are 425 feet in length, 78 feet in beam, and on a draft of 26¾ feet they displace 16,350 tons. The complement of officers and men is 800. The armament consists of four 40-caliber, 12-inch wire-wound guns, four 9.2-inch 45-caliber, wire-wound guns, and ten 6-inch 50-caliber guns, besides fourteen 3-inch and fourteen 3-pounders. There are also four submerged torpedo tubes in the "King Edward" and three other ships, and an additional, or fifth, torpedo tube is built in the stern in the submerged position.

The armor protection consists of a 9-inch belt tapering to 3 inches forward and to 2 inches aft, with which is associated a 2-inch protective deck with an additional 1-inch deck at the gun deck. The side armor is 8 inches thick amidships between the berth and gun decks, and 7 inches thick up to the main deck. The 12-inch guns are protected by 8-inch hoods and 12-inch barbettes, and the 9.2-inch have 7 inches of protection.

The "King Edward" is driven by twin-screw engines of designed horse-power of 18,000. On trial, however, the engines indicated much higher than this, and drove the ship at a speed of 19.04 knots. The maximum amount of coal carried is 2,000 tons, and the total cost of each of these fine vessels is $7,500,000.

The Current Supplement.

The current Supplement, No. 1525, is largely devoted to an exhaustive review of the engineering work on the Simplon Tunnel. The article is written by Charles R. King, a civil engineer, who has made a personal inspection of the work and who writes with an intimate knowledge of its scope. Naturally, considerable care has been taken to illustrate the text fully. Mr. King's treatise will be considered one of the most painstaking that has thus far been written on one of the finest engineering undertakings in the world. Prof. Charles Baskerville's paper on the "Elements, Verified and Unified," is concluded. Emile Guarini contributes an interesting study on various automobile trucks, and presents some striking illustrations of leading types. Prof. Vivian B. Lewes concludes his thorough examination of the theory of the incandescent mantle. Useful formulas for waterproofing fabrics are published. With the ninth installation of Prof. Hopkins's articles on Electrochemistry the series is concluded. Considered as a whole, the articles supply a much-needed want in scientific literature, for there is no book to which the student can turn which will give him such valuable help in experimental work in electrochemistry. For the benefit of those readers who have not read every installment, it may not be amiss to state that the articles have appeared in Supplements 1509, 1511, 1513, 1515, 1517, 1519, 1521, 1523, 1525.

The Charcot Expedition Safe.

News comes from Buenos Ayres, that the Charcot Antarctic expedition has arrived at Puerto Madrin, Argentina. A telegram received from Dr. Charcot is as follows:

"We wintered at Wandel Island and carried out all our scientific work under favorable conditions. The question of Bismarck Strait was solved, our party passing through it. We reached Alexander the First Land, though ice prevented our landing.

"We explored several unknown points on Graham Land. Notwithstanding the fact that our vessel grounded, sustaining a serious leak, we were able to continue the voyage and determine the contour of the external coast line of the Palmer Archipelago."

A plant for burning household waste is now operating very successfully at Zurich, Switzerland. It contains twelve furnace grates which consume 130 tons per day of garbage such as is collected by the city wagons, without adding any combustible. The garbage wagons are unloaded by an electric crane. A powerful air-fan draws air through the furnace and sends it into conduits on each side of the latter. The air is thus heated, and after passing the combustion grate it is sent into the main conduit. This is kept incandescent by the gases themselves, after which the gas is led to the boiler house where it goes into two boilers of 200 square yards heating surface. The steam from the boilers is superheated and then taken by piping into the machine hall. The latter contains a Brown-Boveri-Parsons steam turbine which is direct-coupled to a 200-horse-power alternator furnishing current at 220 volts. The speed is 3,000 revolutions per minute. The plant was first erected with the object of burning the waste only, but it was found that a considerable amount of power could be obtained. Part of the current is used to operate electric motors in the plant and for lighting, and the rest is delivered to the city mains. The cinders, which represent 30 or 40 per cent of the garbage, can be used in the manufacture of a special kind of brick.

What Dr. Osler Really Said.

The sensational press has so unfairly distorted what Dr. Osler really said in his valedictory address at Johns Hopkins University on the subject of men over forty that we take this opportunity of quoting his own words. His plan of chloroforming men over sixty sinks into a humorous perversion of Anthony Trollope's whimsical suggestion:

"I am going to be very bold and touch on another question of some delicacy, but of infinite importance in university life, one that has not been settled in this country. I refer to a fixed period for the teacher, either of time of service or of age. Except in some proprietary schools, I do not know of any institutions in which there is a time limit of, say twenty years' service, as in some of the London hospitals, or in which a man is engaged for a term of years. Usually the appointment is *aut vitam aut culpam*, as the old phrase reads. It is a very serious matter in our young universities to have all of the professors growing old at the same time. In some places only an epidemic, a time limit, or an age limit, can save the situation.

"I have two fixed ideas well known to my friends, harmless obsessions with which I sometimes bore them, but which have a direct bearing on this important problem. The first is the comparative uselessness of men above forty years of age. This may seem shocking, and yet, read aright, the world's history bears out the statement. Take the sum of human achievement in action, in science, in art, in literature—subtract the work of the men above forty, and, while we should miss great treasures, even priceless treasures, we should practically be where we are to-day. It is difficult to name a great and far-reaching conquest of the mind which has not been given to the world by a man on whose back the sun was still shining. The effective, moving, vitalizing work of the world is done between the ages of twenty-five and forty years—these fifteen golden years of plenty, the anabolic or constructive period, in which there is always a balance in the mental bank and the credit is still good.

"In the science and art of medicine there has not been an advance of the first rank which has not been initiated by young or comparatively young men. Vesalius, Harvey, Hunter, Bichat, Laennec, Virchow, Lister, Koch—the green years were yet on their heads when their epoch-making studies were made. To modify an old saying, a man is sane morally at thirty, rich mentally at forty, wise spiritually at fifty—or never. The young men should be encouraged and afforded every possible chance to show what is in them. If there is one thing more than another upon which the professors of the university are to be congratulated, it is this very sympathy and fellowship with their junior associates, upon whom really in many departments, in mine certainly, has fallen the brunt of the work. And herein lies the chief value of the teacher who has passed his climacteric and is no longer a productive factor; he can play the man midwife, as Socrates did to Thesetetus, and determine whether the thoughts which the young men are bringing to the light are false idols or true and noble births.

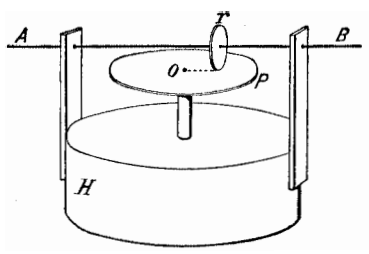
"My second fixed idea is the uselessness of men above sixty years of age, and the incalculable benefit it would be in commercial, political, and in professional life if, as a matter of course, men stopped work at this age. Donne tells us in his 'Biathanatos' that by the laws of certain wise states sexagenarii were precipitated from a bridge, and in Rome men of that age were not admitted to the suffrage, and were called *depontani* because the way to the senate was *per pontem* and they from age were not permitted to come hither. In that charming novel, the 'Fixed Period,' Anthony Trollope discusses the practical advantages in modern life of a return to this ancient usage, and the plot hinges on the admirable scheme of a college into which at sixty men retired for a year of contemplation before a peaceful departure by chloroform. That incalculable benefits might follow such a scheme is apparent to any one who, like myself, is nearing the limit, and who has made a careful study of the calamities which may befall men during the seventh and eighth decades!

"Still more when he contemplates the many evils which they perpetuate unconsciously and with impunity! As it can be maintained that all the great advances have come from men under forty, so the history of the world shows that a very large proportion of the evils may be traced to the sexagenarians—nearly all the great mistakes politically and socially, all of the worst poems, most of the bad pictures, a majority of the bad novels, and not a few of the bad sermons and speeches. It is not to be denied that occasionally there is a sexagenarian whose mind, as Cicero remarks, stands out of reach of the body's decay. Such a one has learned the secret of Hermippus, that ancient Roman, who, feeling that the silver cord was loosening, cut himself clear from all companions of his own age, and betook himself to the company of young men, mingling with their games and studies, and so lived to the age of 153, *puerorum halitu refocillatus et educatus*. And there is truth in the story, since it is only those who live with the young who maintain a fresh outlook on the new problems of the world.

"The teacher's life should have three periods—study until twenty-five, investigation until forty, profession until sixty, at which age I would have him retired on a double allowance. Whether Anthony Trollope's suggestion of a college and chloroform should be carried out or not, I have become a little dubious, as my own time is getting so short."

REGISTERING THERMOMETER.

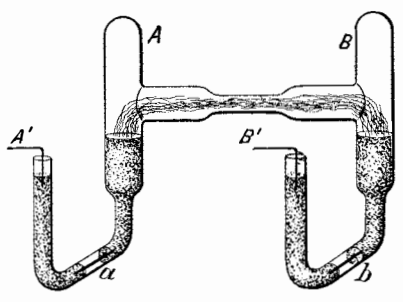
M. Charles Féry, of Paris, has devised a new form of registering thermometer which gives the mean temperature of a given place by direct reading. This form of instrument will no doubt prove of use in different cases. M. Féry used it at the Observatory in making experiments on chronometers, where it was necessary to have the mean temperature. The instrument is constructed as shown in the accompanying diagram. A light shaft, *A B*, supports a disk or roller, *r*. The shaft can be displaced in either direction by a metallic thermometer which is connected with it (the latter is not shown here). By this displacement, the distance *o r* from the roller to the center of the revolving plate upon which it rests is proportional to the temperature. The revolving plate, *P*, is set in rotation by a clockwork movement, *H*. From this disposition it results that the number of revolutions of the roller per unit of time is proportional to the mean temperature. A simple device allows of registering the number of revolutions of the roller, and at regular intervals the revolving plate is caused to drop down for a few seconds so as to allow the roller to take its exact position. This movement eliminates the errors which might arise from the friction of the roller according to the radius *o r*. The apparatus was standardized by the Ostwald regulator, which keeps the temperature constant as long as desired within 1-10 of a degree C. The curve which represents the number of revolutions in function of the temperature is found to be a straight line. It is to be remarked that a very great precision of the clockwork movement is not necessary, seeing that a variation of 15 minutes in a day's run only affects the measurements by one per cent. The mean temperature is registered upon a revolving drum which is divided to 1-30 degree.



REGISTERING THERMOMETER.

A NEW CADMIUM LAMP.

A new cadmium lamp has been recently invented in Germany, and offers considerable interest, at least from a theoretical standpoint. Some seven years ago, Gumlich made a lamp using cadmium and mercury, and the light contained the very brilliant rays of the cadmium spectrum superposed upon the mercury rays. The lamp did not last long, however, as the globe broke very soon. At present two experimenters, O. Lumnur and E. Gehrcke, have taken up the question. Their new lamp is shown in the diagram. It is formed of two vertical tubes, *A B*, joined by a horizontal tube. The lower ends of the tubes are made narrower and are bent twice at an angle. At *a* and *b* is an iridium wire which runs through a solid glass part. The tubes are filled to a certain height with mercury and then sealed at *A* and *B*. Current is brought by wires dipping into mercury at *A'* and *B'*, which are fixed in cement. The experimenters use an amalgam of 14 parts cadmium and 100 mercury in this case. It is soft at the ordinary temperature and becomes fluid when it is slightly heated. To start the lamp it is connected in parallel with an induction coil and the current is suddenly broken, which causes a momentary high potential for starting the arc from *A* to *B*. The lamp continues to work regularly and takes a current of 1 or 2 amperes. It is generally necessary to warm up the lamp before using it, with a Bunsen burner.



CADMIUM LAMP.

The Times correspondent at Colombo states that Sir H. A. Blake, governor of Ceylon, announced at the last meeting of the Asiatic Society that Sinhalese medical books of the sixth century described 67 varieties of mosquitoes and 424 kinds of malarial fever caused by mosquitoes.

Correspondence.

Electrolytic Theory of Dissociation and Digestion.

To the Editor of the SCIENTIFIC AMERICAN:

My attention was recently called to an article published in Vol. xcii, No. 9, of March 4, of the SCIENTIFIC AMERICAN, containing a rather remarkable statement from Prof. R. E. Hirsch, of Ohio State University, to the effect that the theory of electrolytic dissociation could be used to explain some results obtained by him in his experiments upon digestion. The experiments indicated that, when animals were kept on a diet, constant except for the amount of fluid ingested, digestion took place more completely when water was freely used, than when the amount was reduced considerably. The criterion for digestive efficiency was the amount of excretion recovered during the test periods. Prof. Hirsch explains this rather simple and well-known physiological phenomenon on the ground that as the food is more and more diluted, it is correspondingly dissociated, and absorption and assimilation of the food goes on more effectively when it is in the ionic condition than when it exists in molecular form. Such a theory sounds very well indeed, and would doubtless apply to the case in question, were it not true that foods are not electrolytes, and are not dissociated when in solution. In fact, the only parts of our diet which it is possible to convert into the ionic condition in normal digestion are the various metallic salts and the like, introduced as seasoning or present originally in the food material. Our ordinary food stuffs are the fats, the carbohydrates, such as starch and sugar, and the proteids, such as meat and eggs. None of these food stuffs are electrolytes themselves, nor are they converted into electrolytes during the process of digestion, so that the application of the ionic theory to materials which are not ionizable seems rather fantastic.

H. C. BRADLEY.

New Haven, Conn.

[The letter referred to by Mr. Bradley was received by the Editor and published in the correspondence column of March 4, which department of the paper is devoted to miscellaneous correspondence, for which the Editor does not hold himself in any way responsible. It appears that the theory advanced over Prof. Hirsch's name was a forgery, and the following letter from Prof. Hirsch explains the fact that not only does he not hold himself responsible in any way for the statements contained therein, but that he had never seen the letter until it appeared in the columns of the SCIENTIFIC AMERICAN. The Editor is co-operating with Prof. Hirsch in an effort to find out who is the perpetrator of this imposition upon Prof. Hirsch and upon the SCIENTIFIC AMERICAN.—EDITOR.]

A Denial from Prof. Hirsch.

To the Editor of the SCIENTIFIC AMERICAN:

I am this day in receipt of your favor of the 9th instant calling attention to an article published in your journal of March 4, 1905, entitled "Electrolytic Theory of Dissociation," and signed "R. E. Hirsch, Assistant Professor of Chemistry, Ohio State University."

As I am the only person connected with the Ohio State University bearing a name in any way similar to the one suffixed to above-mentioned article, I take it upon myself to inform you that I had never seen the article until my attention was called to it by your letter. I deny any knowledge of it, and would be greatly pleased to have you aid me in any way possible to discover the author of it.

As this is a matter of more than passing seriousness, I hope you will give it due mention in your columns.

RUDOLPH HIRSCH,
Instructor in Agricultural Chemistry, Ohio State University.
Columbus, Ohio, March 13, 1905.

A system of electric road locomotive is now running very successfully at Monheim, Germany. This locality is situated between Mülheim and Düsseldorf on the right bank of the Rhine, and the new line is intended to connect it with the railroad station on the Cologne-Düsseldorf-Berlin line, which lies 2.4 miles distant. A hydraulic station at Solingen furnishes the current. The Schiemann system of track locomotive and car is employed in this case. The locomotive travels upon the main road, without rails, and takes current from two overhead wires. A type of car resembling an omnibus and containing twenty-five places is also used. It carries a 30-horse-power electric motor. A special form of trolley brings the current into the car. The locomotive, which is of large size, is used also for freight, and it takes a train of several freight cars of special construction which are joined by patented couplings. This system is especially useful upon roads where the traffic is not sufficient to warrant the expense of laying a track for the cars. The question of road locomotives and cars has been studied within the last few years, and several systems have been devised which are in successful operation in Europe. Different lines of this kind are now running in Germany and France.

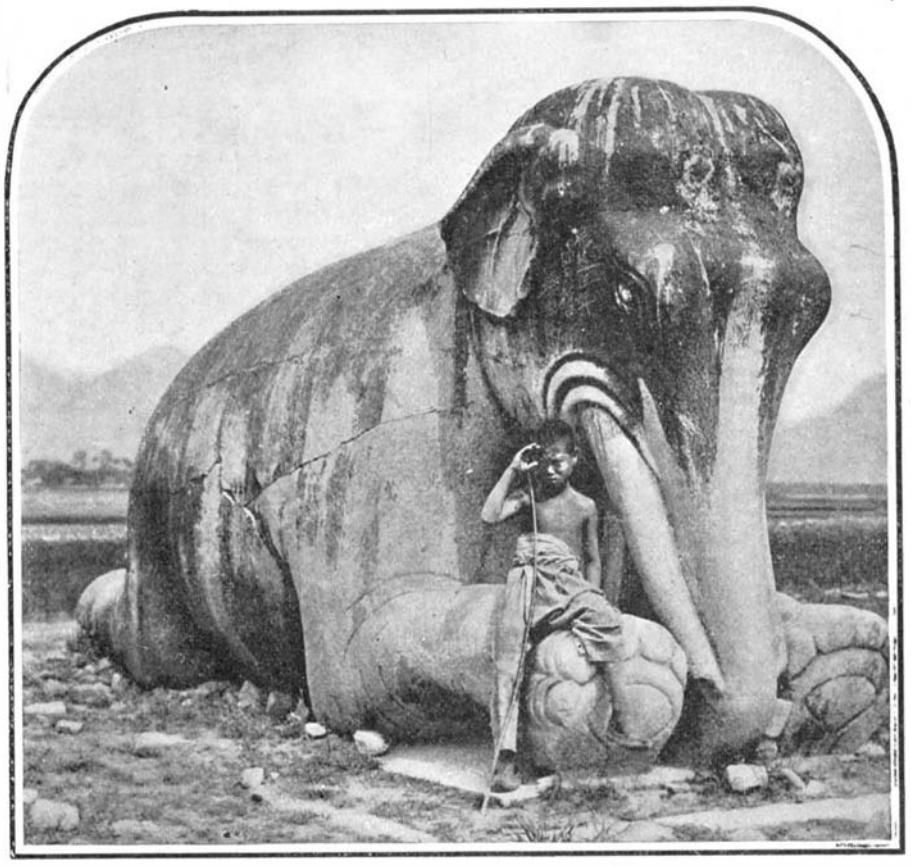
THE TOMBS AT MUKDEN OF THE MING DYNASTY.

The history of China is marked by the alternate rule of native and foreign dynasties. The house of Tsing, to which the present rulers belong, is of Tartar race, and revolutions with the object to free the nation from foreign domination have occurred from time to time, and may break out again, as there are powerful secret societies in China working for the overthrow of the ruling dynasty. As the scepter is now in the hands of the Mantchoo-Tartars, so it was held up to the fourteenth century by Mongolian monarchs. At that time the crown was wrested from the invaders by Tsen-Yueng-Tsang, the founder of the Ming dynasty, who, from a simple bonze or priest, rose to be first a brigand chief, then the leader of a national insurrection, and finally emperor.

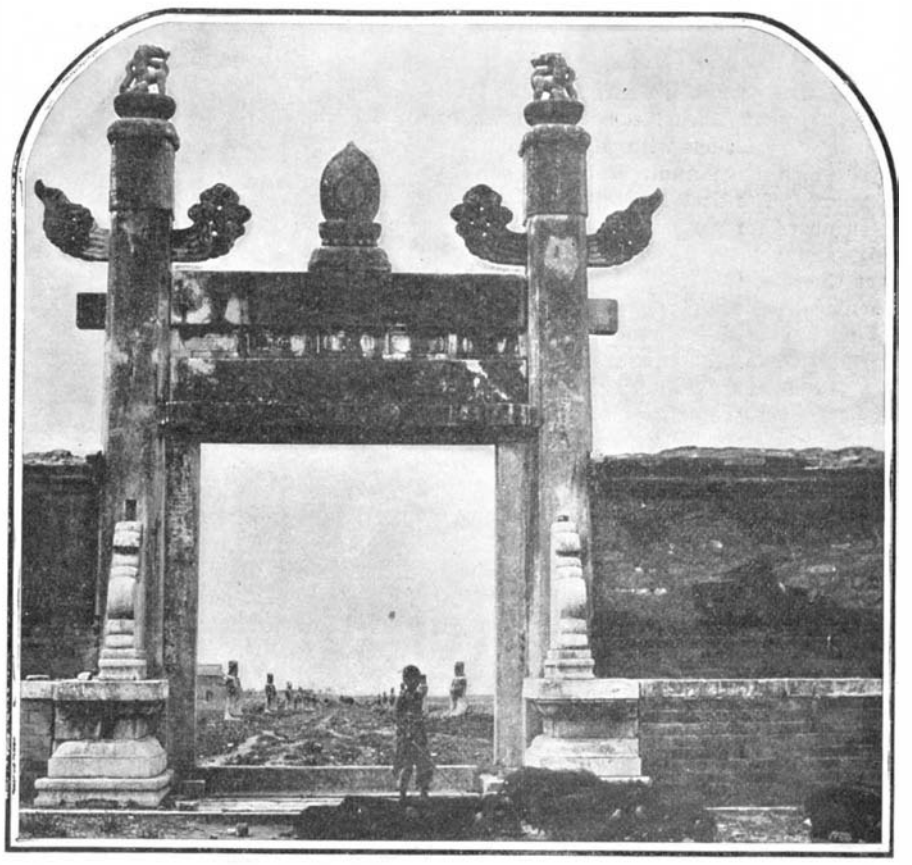
The Mings reigned from 1368 to 1644, when they succumbed to the Tartar invasion. Fourteen emperors of this dynasty ruled China, and they are all buried at the same place near Chang-ping-cho, with the exception of King-tai-hoang-ti, who reigned for Ying-tsung, the fourth emperor of the dynasty, while he was held captive by the Tartars.

The graves are in a plain, so that the entire grounds can be readily overlooked from a near-by hill. Formerly the Mantchoo-Tartar emperors even went so far as to offer sacrifices at the graves of their predecessors; but this practice has been discontinued long ago, and the rites are now performed twice a year by a descendant of the Mings. The emperors are buried with their wives, and originally there prevailed the barbarous custom of burying the women alive with their dead sovereigns. Ying-tsung decreed that the women should be buried in the mausoleums only after their death.

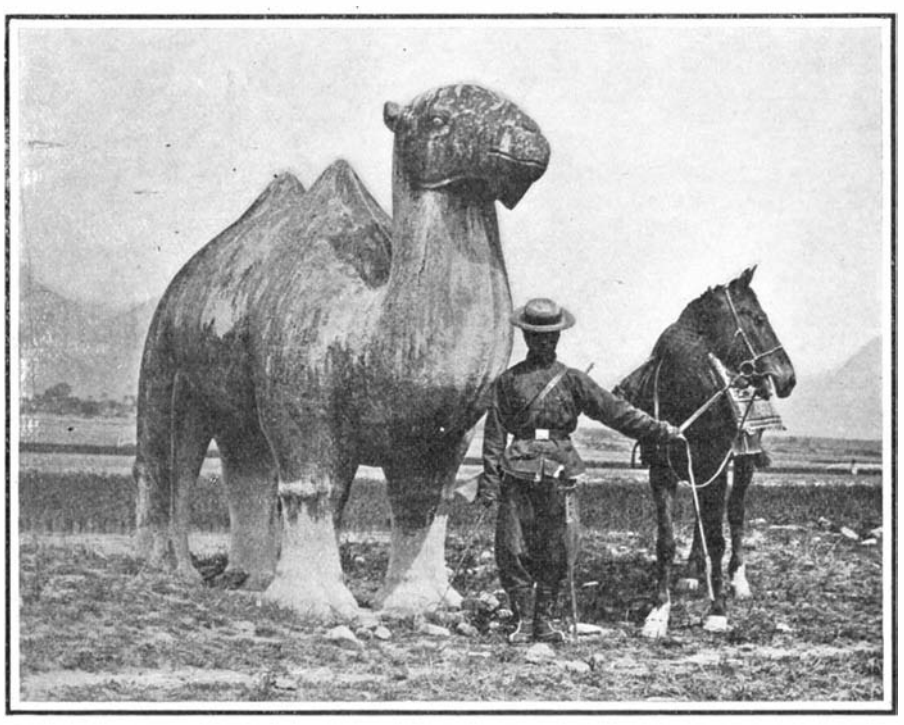
The burial grounds are remarkable not only by the tombs themselves, but by a monumental gate, having five passages or arches, of which the central passage is the largest, the others being progressively smaller. At some distance from this entrance are three gates, called Tahung-men, upon which is carved an imperial edict ordering travelers to alight from their horses. These gates are connected with the entrance by the so-called Holy Road, which in olden times was open to the emperors only; and for the burial of empresses and concubines, they made use of underground passages leading to the tombs; these passages still exist at the present day. The Holy Road is the most interesting feature of the burial grounds. It is lined on both sides with colossal monolithic statues, standing about 200 yards apart. There are in all thirty-six statues, of which twenty-four represent animals and twelve high dignitaries or celebrities. The statues are exceedingly well made and by no means crude productions; their artistic execution is no less a source



An Ancient Ming Statue of a Kneeling Elephant.



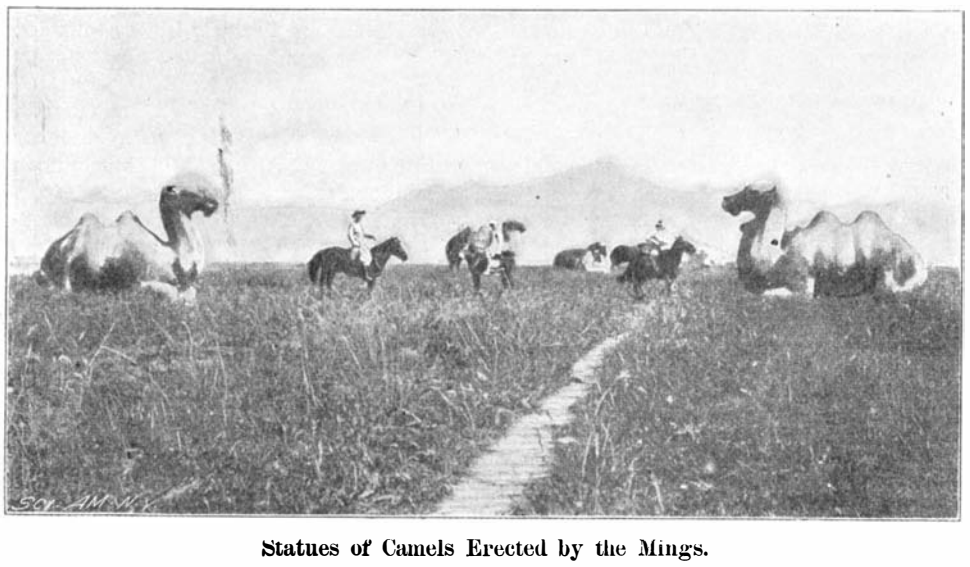
Gateway at the End of the Avenue of Ming Monuments.



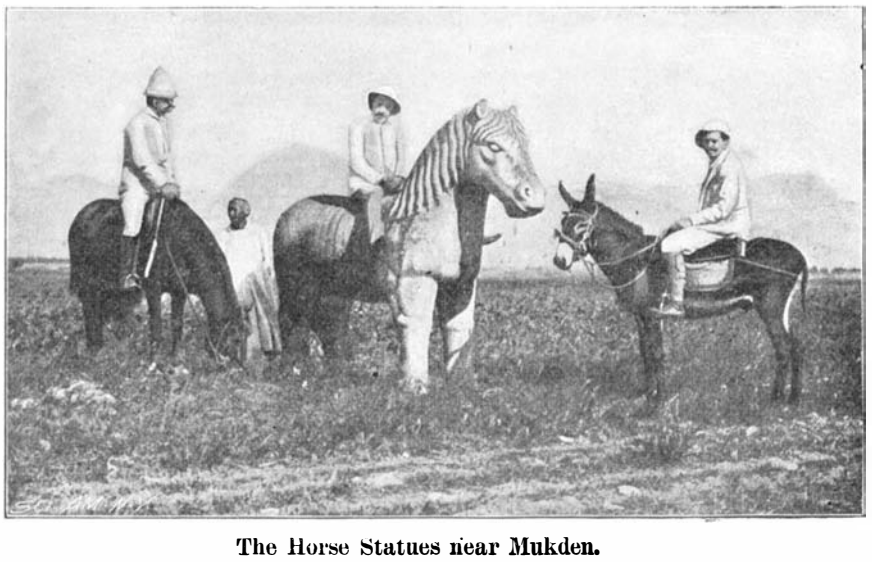
One of the Stone Ming Camels.

Statues of Famous Soldiers.

Photos copyrighted 1902 by C. H. Graves.



Statues of Camels Erected by the Mings.



The Horse Statues near Mukden.

COLOSSAL STATUES AT THE BURIAL PLACE OF THE MING DYNASTY NEAR MUKDEN.

of wonder than the presence of these monuments at a point which evidently is far away from the quarries whence the monoliths were taken. The statues are made without pedestals, and are disposed in groups of four each. First come four lions, then four rams, then camels, elephants, horses, and finally chimeras. In each group two animals are represented standing and the other two lying down. After the animals follow the statues of four military mandarins, four civilian mandarins, and four of China's celebrated men.

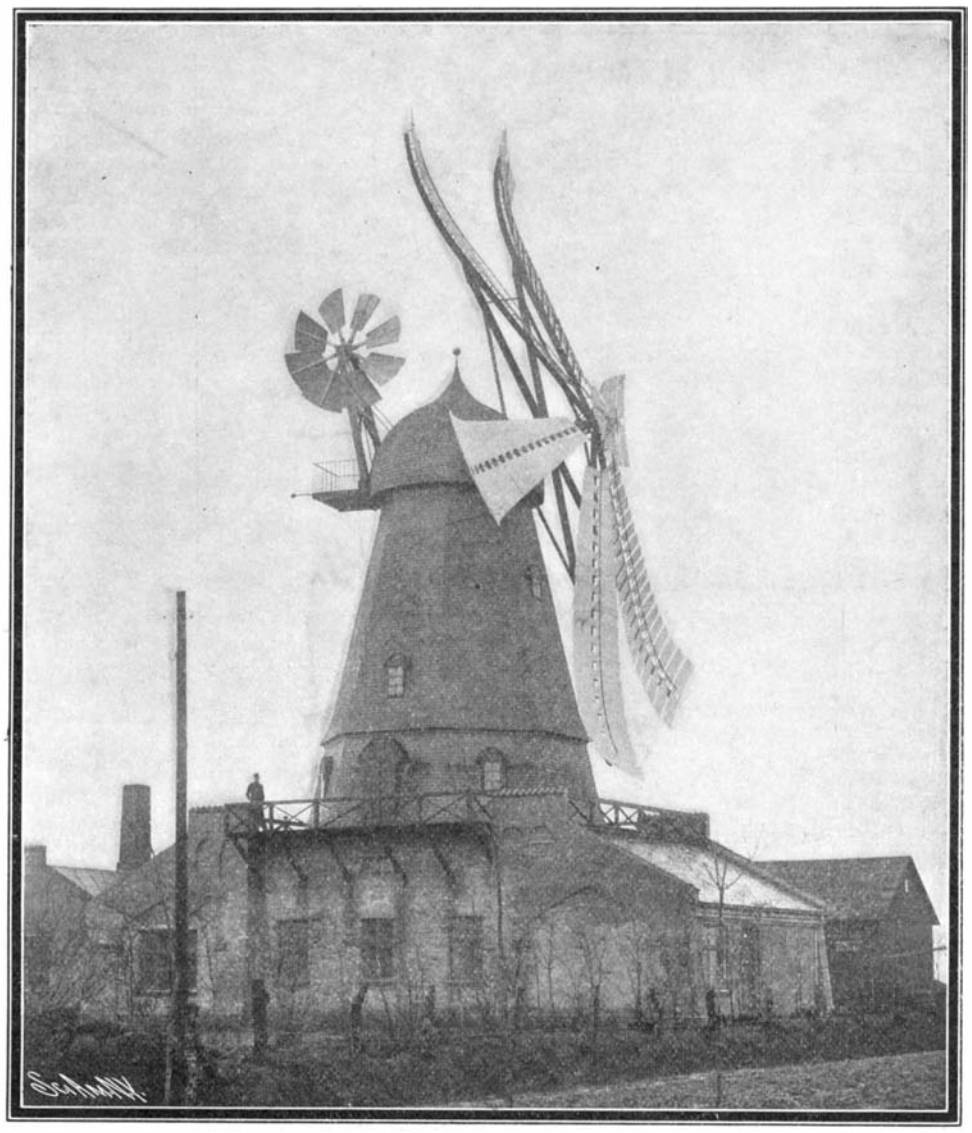
Thirteen hills surround the burying grounds, and from each of them a good general view may be obtained. The impression created by this strange sight is quite peculiar. The statues of the animals, rising immediately from the ground without pedestals, and surrounded by the high grass, have a degree of realism which is entirely lacking in Occidental statuary, with its elaborate pedestals and inclosures. The Japanese authorities issued instructions that the tombs and statues be respected. It is to be hoped that no stray shots in the recent battle may have struck these curious statues.

POWERFUL GERMAN WINDMILLS.

BY CHARLES B. HAYWARD.

In this country, while the windmill is in universal use, its scope of duty seems to be confined almost entirely to the driving of pumps or other water-raising appliances, though experiments have been made to adapt it to the production of electrical energy with the aid of accumulators to tide over periods of calm. However, it is not evident that this was ever carried beyond the experimental stage or that the windmill at its best in this country is much more than a sort of "farmer's assistant," acting in the capacity of a drawer of water.

In Germany this most economical of all powers has been developed to a point that is surprising. The Empire has not the abundant supply of water power with which this country is blessed, nor is cheap fuel present in such quantities. Even the "spiritus" or raw potato alcohol, of which millions of gallons are now annually consumed in hydro-carbon engines, is not as economical a source of power as the wind, though it sells so low as to be the strongest competitor of American petroleum in the German market. Accordingly, a great deal more attention has been paid to the development of means for taking advantage of wind-power than here. This is manifest in the number and variety of articles and books on the subject in German which deal with the windmill as a source of power for general purposes, whereas about the only information of the kind obtainable in this country deals with it in connection with irrigation and is contained in bulletins issued by the Department of Agriculture. Naturally not every locality is suited to the use of a windmill, but a great many parts of Germany have been found to be favorably adapted to its use, both on the coast and in the interior.

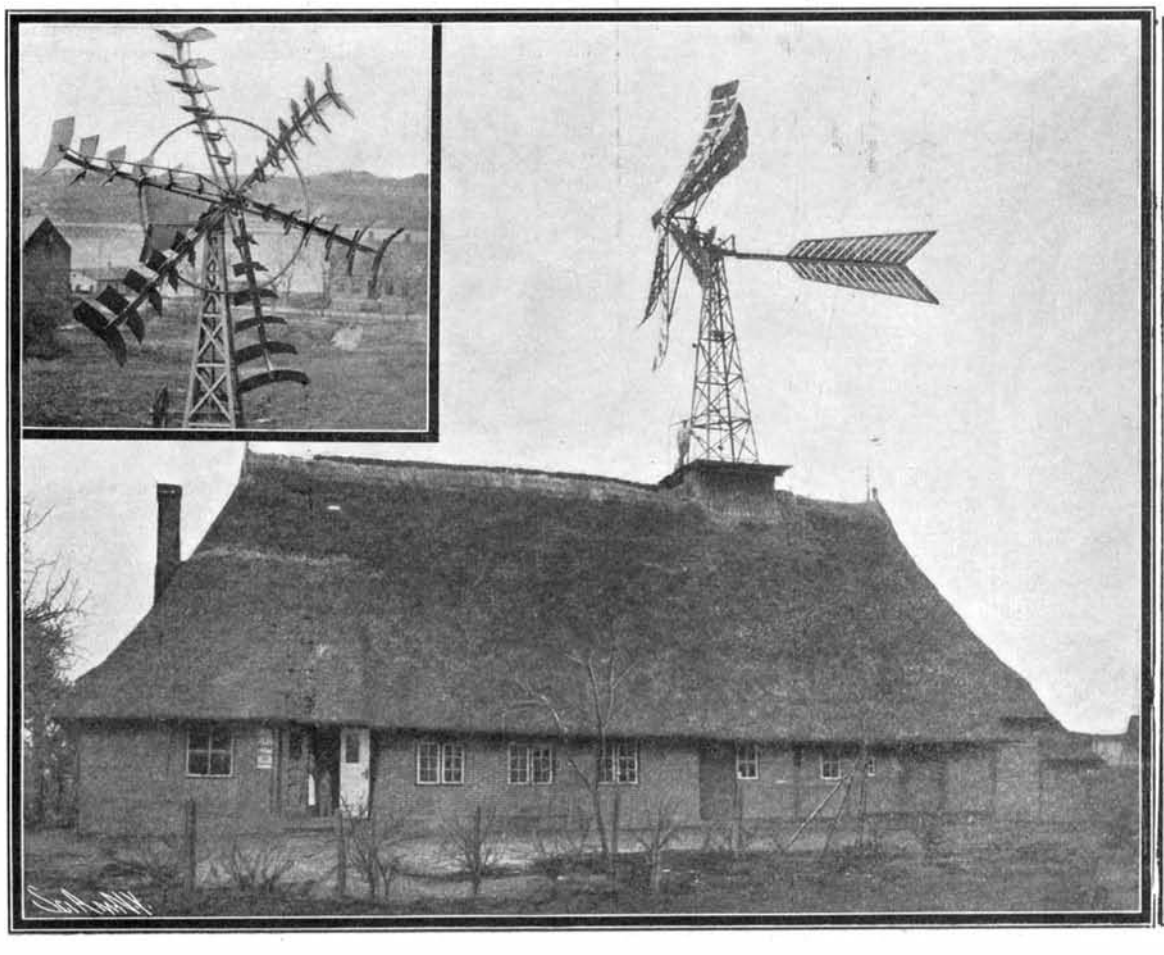


A 50-Horse-Power Wheel. One of the Most Powerful Windmills in Existence. Built for Electric Lighting and General Power Service.

The oldest forms of wind motors are the German or trestle windmill, and the Holland or tower mill, and many of these of both types are still found throughout Holland and North and Central Germany. The Holland form, however, owing to its solidity and general good service, has in large measure displaced the trestle mill. From the modern standpoint both these are very antiquated, as it is now more than a century ago that Americans began to improve upon these types, and the result is the windwheel of to-day. Fixed framing was primarily employed, but later gave way to an adjustable frame, this latter being closely associated with the so-called wind turbines.

The oldest types of these windwheels were those of Allen, Halladay and the Eclipse, while an early type of the present wind turbine was introduced by Leffel. Then there was the Wolff turbine, constructed with a horizontal wheel similar in principle and position to the axial water turbine. But this idea apparently did not meet with success, for the present type has a vertical vane carrier, the guides of which are of arched or scoop form. The horizontal wheel referred to was not the first of its kind by any means, as a patent was granted in England to Robert Beatson, F.R.S.E., for a horizontal windwheel prior to 1798. This, however, was based on an entirely different principle. Like many another inventor, Beatson was confident that his invention was destined to revolutionize windmill construction, and in an essay exploiting it he refers to the fact that horizontal windwheels of the same basic principle were largely used at the time in parts of Tartary and Asia as well as some provinces of Spain. Square sails similar to those of a sailing ship were used, but the great difficulty was that the resistance of the returning vane almost cut in half the power of the active side. In the countries in question this was overcome by screening the idle side from the wind entirely. But one-half of the wheel was thus exposed at any time, and as the screen was not an automatic device it was impractical, owing to the necessity of attendance, to shift it with changes of the wind.

Smeaton disagreed with Beatson on every point and averred that a horizontal wheel could not be constructed that would have the efficiency of the common or vertical type. Beatson's wheel consisted of four upright frames placed at right angles to one another on the arms of a spindle, each frame being filled with a large number of light wood slats or canvas flaps,



A 6-Horse-Power Wheel for Farm Work.

An 18-Horse-Power Wheel, 40 Feet in Diameter.

POWERFUL GERMAN WINDMILLS.

slightly overlapping each other and so hinged or hung on gudgeons as to hold the wind from one side and fly open when blown upon from the other. Thus the resistance of the idle vane to the wind was but a very small fraction of the power developed, as only the edges of the slats were presented. A model of his wheel was erected on the roof of his residence at 15 Great Windmill Street, London, and he figured that with four vanes each twelve feet square it would be capable of developing nine horse-power. He also prepared a table of wind velocity and resistances.

American wheels were largely introduced throughout Germany as a result of the Centennial Exhibition of 1876, and quite a business was done in this class of machinery until the German manufacturer realized that he could build the same thing to greater advantage, and there are at present upward of half a dozen large concerns in the Empire devoted to the construction of windwheels, each operating under a system and patents of its own. The portable windwheel and pump seem to be a feature of this class of power peculiar to Germany, and are used for irrigating, draining, and general agricultural purposes.

Numerous of the smaller towns throughout Germany utilize wind power almost exclusively for their municipal waterworks and in a few instances for public lighting, both of these applications having proved an unqualified success. Needless to add, the utilization of wind power on such an ambitious scale is practically unthought of here. The town of Emden is a good instance of the former, an 18-horse-power, 40-foot wheel being used at its pumping station at Tergast. It is of the slat-vane type familiar in this country, but in place of the usual rudder is equipped with two auxiliary windwheels, as is the case with all high-powered German wheels. These wheels are set at right angles to the main wheel on the end of a bridge-like construction, and are connected to the tower by means of shafts and gearing. Their motion causes the whole upper work to revolve about the tower, thus always maintaining the wheel face to the wind. This feature is a radical departure from American practice which immediately strikes the reader, and may be accounted for by the fact that such powerful wheels have never been employed here in any capacity. The wheel under consideration is coupled to a compound vertical pump having a capacity of 5,500 to 6,600 gallons per hour, according to speed. Its remarkable efficiency is evidenced by the fact that it delivers the water at this rate to a reservoir eight miles distant and 134 feet high. Two 10-horse-power petroleum motors are used as a reserve.

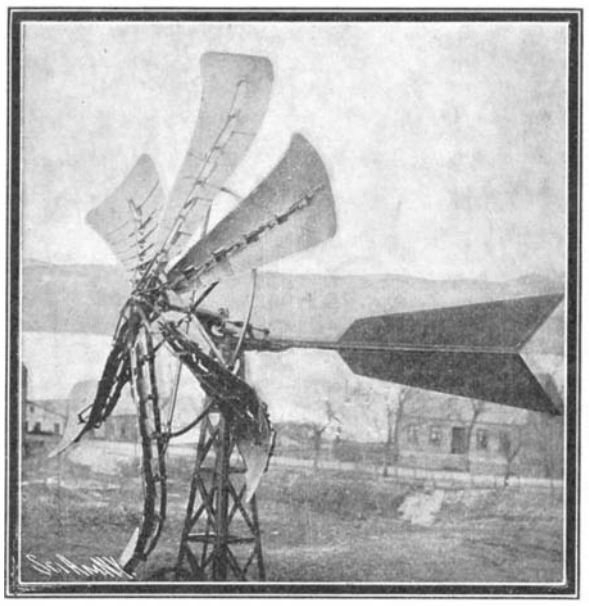
One of the principal German builders, located at Kiel, has for some years past been developing the "Soerensen" system, for which patents have been granted to a Dane of that name. Apparently the principle that has been proceeded on ever since windwheels have been in use is "the larger the surface, the greater the power," but the investigations of Prof. P. La Cour proved the fallacy of this reasoning. Later on Soerensen invented his "conical wind motor" and placed one at the disposal of Prof. La Cour for experimental purposes. The "Ventrokat" and "Windrose," types of German wheels of the highest efficiency, were tested together with a Soerensen wheel, all being of the same diameter, and showed the following results:

	Ventrokat	Windrose	Soerensen
Surface in centimeters.	7,440	2,976	1,188
Power in kilogramme-seconds	1.59	1.77	2.34

Thus the Soerensen motor developed 50 per cent more power than the Ventrokat with a surface of one-seventh the area, and 33 1-3 per cent more than the Windrose with its 2.8 times greater area, and 29 per cent more power than an earlier type of Soerensen motor which had but 7 per cent less surface.

The extraordinary superiority of this motor over existing types is due in great part to the form of its vanes, particularly at their ends, where the greatest wind pressure is exerted, but the unusual distance between the vanes adds an element of power, the importance of which has hitherto been totally overlooked. This space not only permits of the passage of the wind between the arms so that the latter meet with greatly decreased resistance in revolving, but a vacuum is seemingly created, and this with the absence of back pressure accelerates the motion of the wheel.

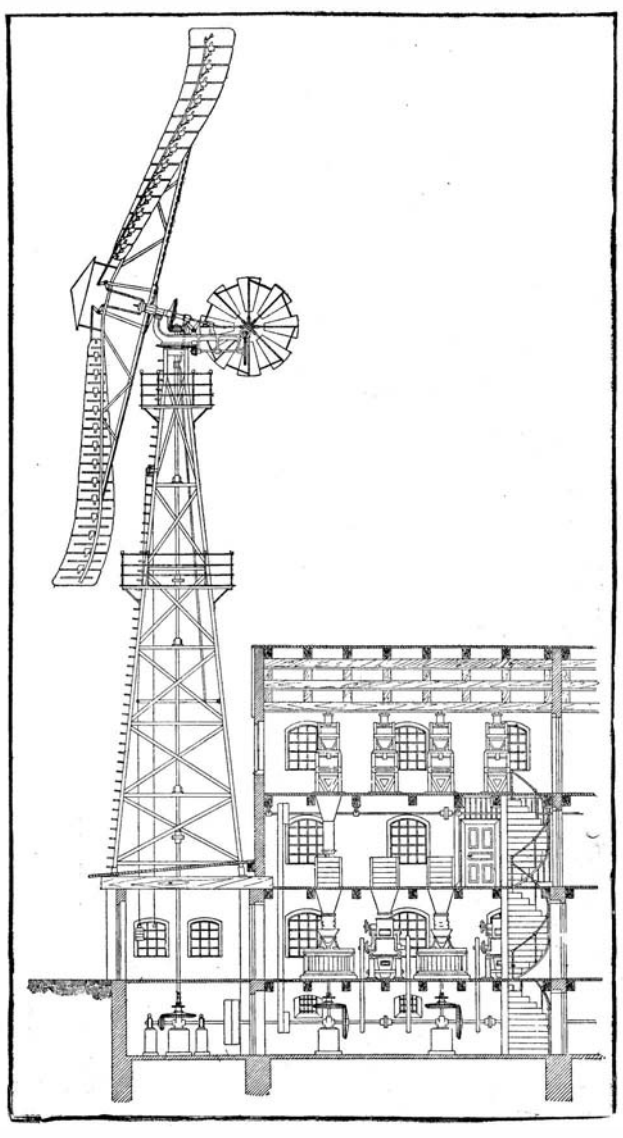
Some of the illustrations show a 6-horse-power wheel for pumping, mounted on a barn roof, and a 9½ and a 15 horse-power wheel respectively, the latter supplying power for quite extensive milling plants. The huge tower wheel shown was designed and built especially for electric lighting. With the wind at 7 meters (or approximately 23 feet) per second it develops 50 horse-power and is without doubt the largest wheel ever built for any purpose. Naturally the most difficult problem to be overcome in adapting the windwheel to electric lighting is the matter of speed regulation, but this has been very successfully solved by means of various regulators, prominent among these being the Rontescher "Tourenregler." By reason of the high first cost and expense of maintenance of a battery of accumulators of sufficient capacity to relieve the generator of the above wheel during periods of calm, it has been found much more economical to install gasoline engines as a reserve. How infrequently the latter are needed is evident from the fact that during the



A 4-Horse-Power Wheel for General Farm Work.

two or more years this set has been in use, there have scarcely been thirty days per annum in which the wind failed.

In this connection it is interesting to note that a plant of the above type using gasoline power as a substitute and representing a total investment of 18,000 marks has earned a net dividend of 12 per cent on the capital, while the same plant with gasoline power alone installed at a cost of 11,000 marks falls far below this. As already referred to, a public electric lighting service depending upon wind power is successfully maintained in a Danish village, so there is no reason why isolated farms cannot accomplish all the power work necessary by means of electric current generated by a windwheel. For periods of calm horses may be substituted. It is further the practice to equip such plants with two dynamos, one much smaller to be used



Section Through a Wind-Power Plant.

GERMAN WINDMILL PRACTICE.

with a moderate wind, both being run in very heavy winds.

A 15 horse-power wheel of the Soerensen conical type is employed to run the machine shop at a small government dockyard in the town of Husum, Germany, and is very efficient. With a wind speed of exactly 4.4 meters, or 6.7 miles per hour, this wheel has driven a 12-foot engine lathe, a shaper, a blower for two forges, and a circular saw of 20 inches diameter, sawing a 7-inch oak log, all the machines being driven at the same time and at full speed.

MULTI-FIREARMS OF ANCIENT TIMES.

A very rare and curious specimen of an ancient repeating flint-lock pistol has lately come into the possession of Mr. Sumner Healey, of this city. The pistol, of which we produce a drawing and photograph, was made at the end of the seventeenth century by Wetschgi Augustus, who died in Vienna A. D. 1690. The pistol contains two magazines, one, *A*, which contains the powder, and the other, B, contains the balls, twenty-one in all. An additional priming magazine *H* is on the outside of the lock and close to the flash pan. To load, one depresses the muzzle and turns or rotates the cylinder *C* by means of its exterior lever. One of the balls contained in the magazine *B* drops into the cavity *E*, which comes opposite *B*. At the same time the powder chamber *D* of the cylinder is filled with powder from the magazine *A*. When continuing to rotate the cylinders, the ball contained in the cavity *E* falls into the funnel-shaped breech, and by a continued motion of the cylinder the cavity *D* is brought opposite the breech of the barrel, where it remains until the shot is fired. During this time the reduced prolongation of the cylinder at the exterior rotates and scoops from the magazine *H* a sufficient quantity of powder to prime the flash pan. A continued movement closes the flash pan cover *G* and brings the hammer to full cock. When the pistol is fired, the priming charge shown at *E* communicates the fire through the two small holes to the charge contained in the cylinder.

The weapon bears the following inscription: FECIT ET INVENTIT WETSCHGI AUGUSTAE.

It may be readily seen that unless the revolving cylinder is accurately fitted, the danger of using such a weapon must be great, the powder in the butt, sufficient for twenty-one charges, being separated from the barrel only by the revolving cylinder, which serves as a false breech for the barrel.

A weapon of like construction to the above is in the Musee d'Artillerie, Paris, and is catalogued as M1766, but very few of these weapons, either gun or pistol, are known to be in existence. Among others who built similar weapons are Jan Sander, of Hannover, and Antonio Constantin, of Ferrara, Italy.

From a military point of view, the design of the arm gives evidence of being far in advance of its time. If everything works properly, the arm can be fired nearly as quickly as a modern weapon of to-day. Very little time is required for charging, and it is only necessary to fill the compartments with bullets and powder through the orifice *F*, with no counting and measuring. The charges are automatically measured, and the load is fully as accurate as that of metallic cartridges.

Altogether, the design and workmanship of the pistol make it a most valuable and remarkable relic.

Another pistol in the same gentleman's collection is a four-shot flint-lock pistol (Fig. 7). The weapon is evidently of English origin, and was presumably manufactured about 1750. It has two separate hammers, two triggers, and two separate flash-pan covers. The two upper barrels are fired separately by pulling the respective triggers. When these are fired, to fire the lower barrels one turns the lever shown at the center of the pistol, which brings two fresh primings in contact with the sparks from the flints, and thus communicates the flame to the two lower barrels through an orifice which is opened by the turning of the lever.

The arm can be fired quickly. All that is necessary after the first two shots are fired is to reclose the flash pan covers and to recock the hammers.

Fig. 8 shows a two-barrel, English flint-lock pistol with spring bayonet attachment, made by Nock, the celebrated London gunsmith. The pistol works on the principle of that shown in Fig. 7, with the exception that it has two barrels and one hammer and flash-pan cover only.

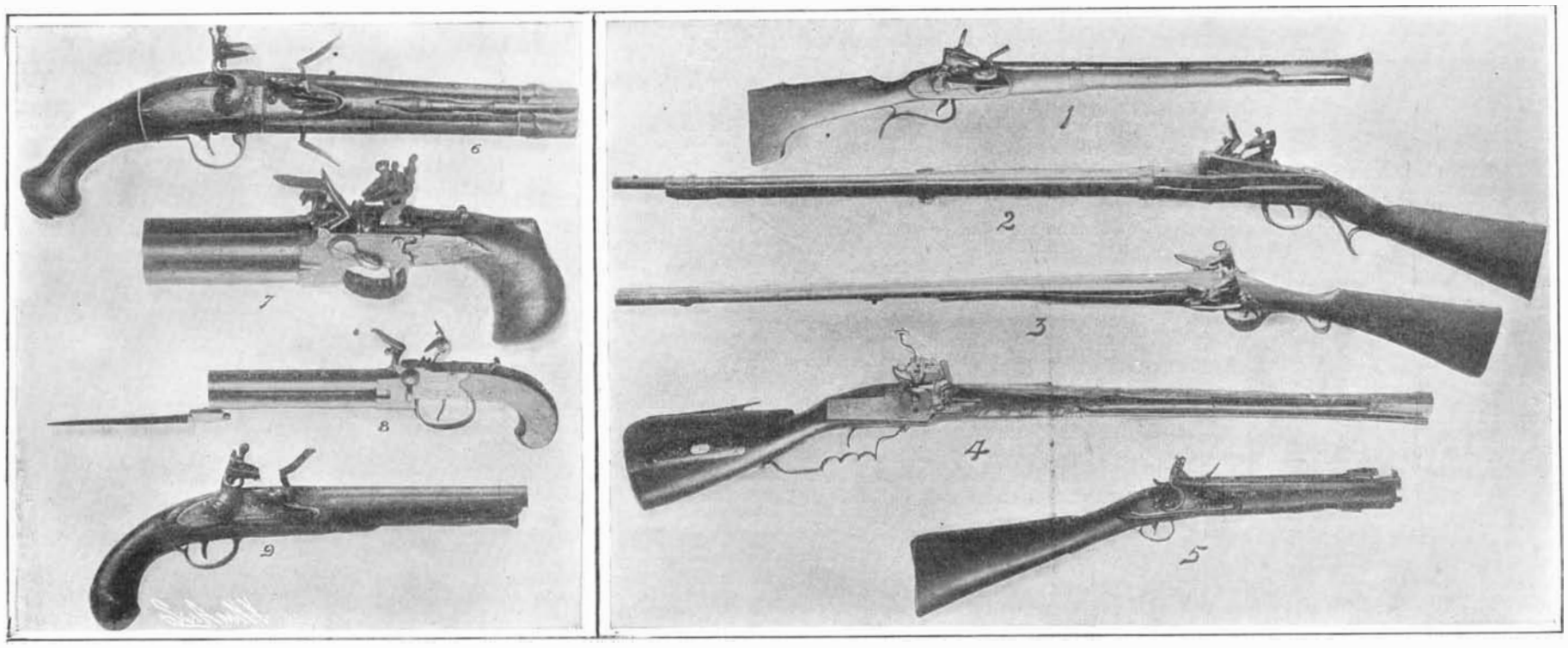
Fig. 9 shows a United States flint-lock pistol, caliber 70, made for the United States government by Simeon North, Berlin, Conn., about 1813. No pistol made for the government in early days is so much sought for by collectors as this, known as "North's Berlin." On the lock plate, in the rear of the hammer is stamped "S. North, Berlin, Con." Between the hammer and the pan is an eagle and under the eagle is stamped "U. States."

This particular model was only made one year, and but very few are known to be in existence.

Fig. 6 shows a two-barrel, revolving flint-lock pistol made by Bauduin, a French gunsmith, about the middle of the eighteenth century. This arm may readily be called the precursor of the modern revolver. The top barrel being fired, one revolves the barrels by hand, and as soon as the hammer is recocked, the pistol is ready for the second shot.

Among some guns in the same gentleman's collection, photographs of a few of which we reproduce, is that

figured 1, which is an example of the early Spanish snap-hammer blunderbuss, made about 1700. Fig. 5 illustrates an English blunderbuss, manufactured by Twigg, of London, and shows the blunderbuss in its most perfected form. The arm, besides being a firearm, carries a folding bayonet on top of the barrel. Similar arms were much used in England in the latter part of the eighteenth century, most of the guards of the old English mail coaches carrying them in a special compartment at the rear of the coach. Fig. 2 shows John H. Hall's patent breech-loading flint-lock rifle. This arm



6. French two-barrel revolving flint-lock pistol made about 1750. 7. Four-shot English flint-lock pistol made about 1750. 8. Two-shot English flint-lock pistol with spring-bayonet attachment. 9. "North's Berlin" U. S. pistol made in 1813.

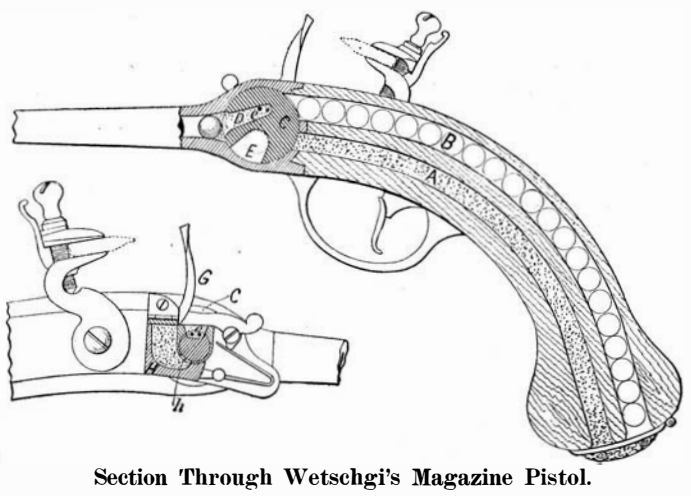
1. Spanish snap-hammer blunderbuss made about 1700. 2. First breech-loader ever made in the U. S. 3. Spanish double-barrel flint-lock gun made about 1700. 4. German rifled wheel-lock arquebus made about 1620. 5. The most perfect form of English blunderbuss. A folding bayonet is carried on top of the barrel.

is the first breech-loading weapon ever patented in the United States, and was patented by William Thornton and John H. Hall, May 21, 1811. In 1815 Mr. Hall first brought to the notice of the government the advisability of making all parts of a gun interchangeable with any other gun of the same model. In 1819 John H. Hall contracted with the United States government to manufacture a certain number of these breech-loading flint-lock rifles. The gun can well be described as the first successful breech-loading military arm, and also the first gun ever built on the interchangeable plan. Fig. 3 shows a Spanish double-barrel flint-lock gun of the beginning of the eighteenth century. While a few double-barreled guns were made some time prior to this in Italy by some Italian gunsmiths, the Spanish craftsmen were the first to forge a light, strong, and accurate-shooting double-barrel. In later years the double-barrel flint-lock gun was brought to its high state of perfection through the efforts of Joseph Manton and a number of other English gunsmiths. No. 4 illustrates a German rifled wheel-lock arquebus, made about 1620. It is believed that guns were first rifled by Gaspard Zollner, of Leipsic, about 1498; others say by Augustus Kotter, of Nuremberg, about 1500. In 1631 William, Landgraf of Hesse, had several companies armed with rifled carbines. The earliest authority we have for rifling in England is an English patent dated 1635.

The same gentleman has a number of United States flint-lock muskets dating from 1799, when the first musket was made for the United States government, to 1842, when the last of the flint-locks were made.

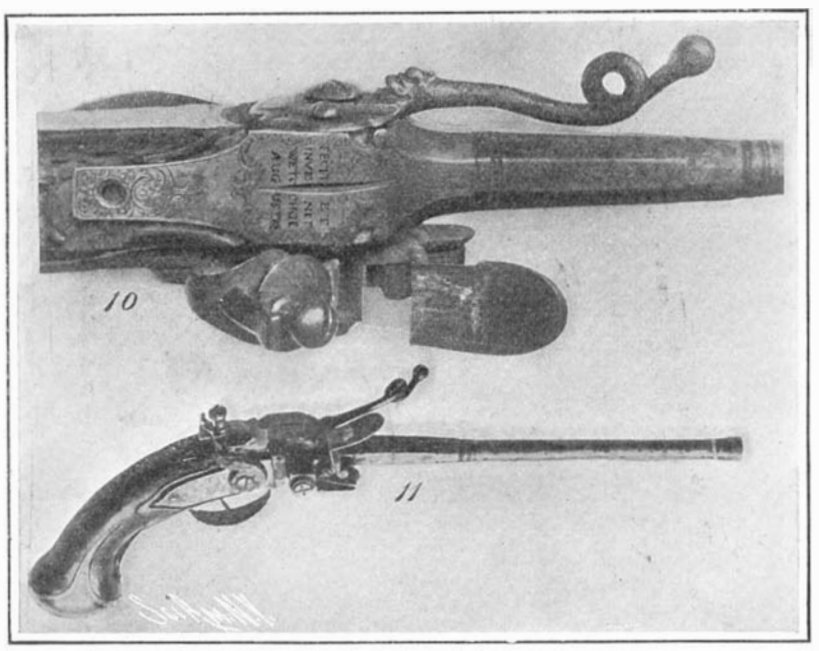
Altogether, the collection, although small, gives evidence of having been carefully and tastefully selected.

Antique Pistols and Rifles.



Section Through Wetschgi's Magazine Pistol.

Made about beginning of eighteenth century.



Wetschgi's Pistol.

10. View of priming mechanism. 11. General view of pistol.

SOME REMARKABLE OLD PISTOLS AND RIFLES.

Prof. C. E. Reeves, of Benton Harbor, Mich., makes use of an ingenious application of the principle that the product of two parts is greatest when the parts are equal, to multiply numbers of two figures when their difference is not over twenty. By taking two numbers having the same sum as those whose product is required, one of which is a multiple of ten, you are able to find their product by using a multiplier with only one significant figure. This product will vary from the desired one by the product of parts of the difference of the more remote factors shown by the other pair of factors and will be that much too small if the new factors show the greater difference, or too large if the reverse be true.

To illustrate, let it be required to multiply 18 by 23. The nearest multiple of ten is 20, and 21 is the other new factor, giving a product of 420. The difference of 5 between 18 and 23 is divided by the 20 into two parts, 2 and 3, whose product, 6, must be taken from 420, giving 414, the product desired. In squaring numbers the rule becomes very simple. For example, to square 47 you multiply 50 by 44 and add the square of 3, which gives 2209. The rule seems well adapted for use by accountants, builders, and estimators where much multiplying is required.

An important water-power scheme has been authorized by the government of the Swiss canton of Schwyz. A barrage 78 feet high, 127 feet long at the base and 307 feet at the top, is to be built across the River Sibl. The result will be the formation of an extensive lake, with a superficial area of eight square miles near Einsiedeln. Existing roads through the valley are to be replaced by bridges, one of which will be 3,153 feet in length. An immense motive power will be derived from the water as it flows into Lake Zurich, 1,500 feet below,

Ives' New Process Replicas of Rowland Gratings.

Thorp's method of reproducing Rowland spectroscope gratings by making a celluloid cast and mounting it on glass has produced copies good enough for some purposes, but the celluloid film always distorts sufficiently to mar the definition more or less, so that even the best of them define better over some limited portion of their area than over all. They give the best results only when the rays entering the spectroscope are practically parallel, as with direct sunlight without a condenser, and transmitted through a selected limited portion of the grating. Even then, owing to some scattering of the light, which manifests itself as a pale fringe or halo about the lines in bright-line spectra, the lines of the solar spectrum do not appear as black as with the original Rowland grating. Even if the celluloid film did not stretch, the manner of putting it down on glass would cause the inevitable slight unevenness of thickness not only by refraction to destroy the perfect parallelism of the emerging rays, but would distort the plane of the diffracting surface, and the difference in refractive index of the celluloid and glass would produce disturbing reflections between the two surfaces of the replica. The defects introduced by any one of these sources of error may be slight, but that altogether they are of very material importance the result always shows.

By a remarkable improvement upon this method, made by F. E. Ives, replicas giving entirely satisfactory definition are now made, and so finished that they are no more easily injured than glass prisms.

This improvement is effected (1) by making the casts in a harder and less elastic material than celluloid, by (2) putting them face down upon the glass and forcing them into optical contact therewith, so that the perfect plane of the diffracting surface is preserved, and by (3) sealing them up under another plane glass, with a balsam mixture having the same refractive index as the casting material, so that the perfect parallelism of the transmitted ray is insured, and at the same time the grating is protected from injury.

The Good Old Times.

According to one of the old English chronicles, royalty, in 1234, had nothing for a bed but a sack of straw. Even in the days of Queen Elizabeth at least half of the population of London slept on boards. Blocks of wood served as pillows. The sleeping chamber of the Queen was daily strewn with fresh rushes. Carpets were unknown. Henry VI. immediately on arising tossed off a cup of wine. Tea, coffee, and chocolate were, of course, unheard of at that time. Sugar was to be had only in drug stores, and then by the ounce. These were the good old times.

Steel castings are manufactured with open-hearth furnaces and with small converters. Where castings of various sizes are made, as in a general steel foundry, a small open-hearth furnace affords excellent results, as it gives control over both the composition of the steel and the melting temperature.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

APPARATUS FOR ELECTRICAL SIGNALING.—L. Despradels, 20 Rue du Chateau d'Eau, Paris, France. The apparatus is so arranged as to allow of obtaining by means of a cheap construction an easy and ready transmission of signals between two or more stations at the same time. It can be used for signaling by wire, as ordinary telegraphic apparatus, as apparatus for signaling for railway, as fire-alarm, as commutator for electric bolting, as calling apparatus, a commutator in telegraph or telephone stations when several are connected to one and same wire, as registering gyrometer, as sound-controller, and the like. Also used for signaling without a wire as calling apparatus or commutator in being introduced with Morse telegraph into the circuit of the Branly tube.

Of Interest to Farmers.

CORN-CUTTING MACHINE.—C. Leidy, P. V. Johnson, and J. G. Martin, Fostoria, Ohio. In this patent the invention relates to harvesting-machines, and especially to that class used for cutting corn. The principal objects of the invention are to provide a machine capable of being drawn by three horses and which will cut two rows of corn simultaneously, which will support a shock and afterward discharge it from the machine, and will cut the stubble.

BAND-CUTTER AND FEEDER FOR THRESHING-MACHINES.—F. Fredeen, Taylors Falls, Minn. In respect to one of its features the invention is an improvement in that class of attachments for threshing-machines in which the feed or advance of the grain to the threshing-cylinder is automatically regulated and kept practically uniform by a governor, preferably by one comprising a friction-wheel variably rotating in contact with a disk upon whose face it is radially, automatically, and variably adjustable for producing fast or slow speed. Operation of the rakes or means for feeding the grain is thus governed automatically according to the quantity and condition of the grain.

Of General Interest.

SIGN.—R. M. Pearson and W. Letzig, Little Rock, Ark. The object of the inventors is to provide a new and improved sign which is very attractive both in the day-time and at night, the sign-letters being wholly illuminated and readable on both sides of the sign and illuminated by the same source of light at a comparatively little expense.

GATE-VALVE.—R. J. Powers, Chicago, Ill. The invention has reference particularly to improvements in gate-valves for sewer-pipes, the object being to provide a gate-valve of novel construction so arranged as to automatically close the sewer pipe and prevent the inlet of waste or sediment should a backflow of water occur.

BOTTLE-STOPPER.—E. Campbell, Rossland, Canada. The principal object of this invention is to provide a stopper designed to be inserted within a bottle or similar vessel, which stopper after it has been securely sealed in the neck of the bottle is so fractured or marked that it will be impossible to refill the bottle after the original contents have been removed and without insuring detection of the fraud.

CASING-HEAD.—F. E. Howe, Marietta, Ohio. Mr. Howe's invention relates to an improvement in casing-heads and means for connecting it with the casing in oil, gas, or artesian wells so as to prevent the leakage of fluid from the well, its object being to produce a device which shall be efficient, cheap, easily applied, and one which can be applied in varying sizes of casings.

COMPOSITION OF MATTER FOR FORMING PIPES OR TUBES, ETC.—J. S. Gregg, Pomona, Mich. The improvement relates to the manufacture of pipes or tubes, etc., from plastic cement, and has for its object to provide a novel plastic composition by means of which tubing can be readily and quickly produced. The materials employed in the manufacture consist of equal parts of a good quality of powdered cement and sand and a suitable quantity of powdered resin, all mixed with water impregnated with liquid glue.

CAP-FASTENING FOR VESSELS.—A. Brockelbank, Ossining, N. Y. The purpose of this invention is to provide a construction for the neck of a bottle or like receptacle and a construction of cap for the same which will enable the cap or cover to be quickly placed in closed position on the receptacle and turned to a locking engagement with the neck of the receptacle and further turned in the same direction to provide for a convenient removal of the cap or cover from the receptacle.

RECEPTACLE FOR CIGARETTES.—A. Q. Walsh, New York, N. Y. The purpose of this invention is the provision of a receptacle especially adapted as a receiver for cigarettes and to so construct the receptacle that ready access may be gained to even the last cigarette therein and so that the cigarettes will be kept moist in a manner which will not affect their color or flavor.

METHOD OF MAKING CULINARY STOCK.—W. B. Kerr, Medford, Mass. The invention relates to the manufacture of food products; and its object is to provide a new and improved method of making culinary stock, which stock can be readily converted by the consumer into an easily-digested, nourishing, and palatable stew having the flavor of malted oysters, clams, and like bivalves.

MEANS FOR SUPPORTING CHINAWARE IN GLAZING-KILNS.—F. G. Haney, East Liverpool, Ohio. The inventor's object in this instance is to provide means for reliably supporting dishes and the like in saggers, so that the dishes will be maintained nearly upright and the points of contact between the ware and the supports reduced so as to have scarcely any area, and also that these points of contact with the ware be located where any slight defect will not mar the general surface of the glazed ware.

CABLE-CLIP.—W. Greger, Barron, Wash. This invention has reference to improvements in clips designed for engaging with a wire cable, an object being to provide a clip that will overcome the strain and adapted to pass over the deep-flanged sheaves and also so constructed as to pass freely around the large grip-pulley and under the holddown-sheaves.

BATH-SUIT BAG.—W. A. Allen, New York, N. Y. The purpose of this invention is to provide a bag adapted to carry a folded bathing-suit to and from the body of water in which the bath is to be taken, the said bag being particularly adapted for use in connection with bathing-suits for men, and to so construct a bag that it will be durable, economic, simple and waterproof, or substantially so, and to provide a construction of bag which when filled, closed, and locked will constitute a sightly, compact package of small size, having a handle by which it may be readily supported from the carrier's wrist.

Railways and Their Accessories.

AUTOMATIC RAILWAY-SIGNAL.—J. C. Lambert, Tonica, Ill. This invention refers to means actuated by passing of rolling-stock over selected portions of a railroad-track which show a signal, sound an alarm, or give both automatically, and has for its object to provide construction for an automatically-operated signal which is reliable in operation, which may be employed on single or double track railroads, signal trains or stations in either direction of travel on the road, and be adapted for repair of signal device quickly and cheaply.

INCLINED RAILWAY.—S. E. Jackman, New York, N. Y. Mr. Jackman's invention relates to railways such as are principally used for amusement in pleasure resorts, exhibitions, and like places. The object is to provide a new and improved inclined railway arranged to utilize the ground-space to the fullest advantage by providing a long up-track without diminishing the rise thereof for the purpose of requiring less power to haul cars up the track.

MAIL-BAG-DELIVERY DEVICE.—J. S. Kauffman, Degraff, Ohio. In the form of this inventor's improvements he employs specially constructed and organized devices at a railroad-station for delivering mail-bags to a catcher therefor on a moving car, as well as other specially constructed and organized devices on the car for similarly delivering mail-bags to a catcher therefor at a station, said devices being adapted to be operated conjointly or practically at the same time and each set being adapted to be operated independently either to deliver a bag or to receive one from the other. The device is inexpensive, effective, and reliable and possesses the capacity for long and repeated service.

Pertaining to Vehicles.

BICYCLE ATTACHMENT.—B. R. Pepper, Yazoo City, Miss. In this instance the intention of the inventor is the provision of a new and improved bicycle attachment arranged to store up power on a downgrade for use in propelling the bicycle on a level grade or on an upgrade to secure riding as easy as possible. It may be attached to other wheeled vehicles.

Prime Movers and Their Accessories.

HYDRAULIC PUMP.—R. H. Russell, Galveston, Texas. The inventor's object is to provide means whereby fluid may be employed and used over and over again in transmitting power for working the fluid elevating or pumping means. His broad conception comprehends the use of liquid, air, or gas placed under pressure and conveyed to the pump for working it. A liquid-elevating pump is employed having a special reciprocable hollow piston, means for conveying fluid under pressure into the pump-cylinder alternately at opposite sides of its piston, and peculiar means whereby fluid-power means is alternately fed to pumping-cylinder through operation of a controlling-valve.

SMOKE-CONSUMING FURNACE.—J. B. Harris, Nashville, Tenn. The object of the present invention, which relates to smoke-consuming furnaces, such as shown and described in Letters Patent of the United States formerly granted to Mr. Harris, is to provide a furnace arranged to cause a reduction of the volume of nitrogen in the fire-box by introduction of minute jets of steam to deflect the rising gases and smoke in the fire-box, to bring same near the air-inlet ports for mixture with air drawn in by action of steam-jets, and to insure a more ready and complete combustion of the mixture.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6635.—For manufacturers of small chains, like bicycle chains, small enough to take the place of tape which operates typewriter carriages.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6636.—For manufacturers of pearl buttons.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6637.—Wanted, addresses of automatic vending machine or coin slot machine manufacturers or dealers.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6638.—For parties manufacturing machinery for making improved cross-head bale ties for hay.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6639.—For manufacturers of artesian wells with automatic pressure system or chemical engines for the purpose of waterworks and fire protection.

One-eighth horse power battery motors, $5 each. Walsh's Sons & Co., Newark, N. J.

Inquiry No. 6640.—For firms selling large machines for loading shotgun shells, same being loaded by power and capacity being 20,000 to 30,000 per day.

Commercially pure nickel tube, manufactured by The Standard Welding Co., Cleveland, O.

Inquiry No. 6641.—For manufacturers of machines testing the saturation of paper.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6642.—Wanted, information on the recovery and marketing of wool grease or lanoline; also manufacturers of a plant to extract the same.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 6643.—For manufacturers of an endless 36-inch steel band, like an endless band saw, save that it must have a sharp, continuous cutting edge like a knife.

In buying or selling patents money may be saved and time gained by writing Chas. A. Scott, 719 Mutual Life Building, Buffalo, New York.

Inquiry No. 6644.—Wanted, address of the Discal Engine Co.; also makers of crude petroleum engines.

We manufacture iron and steel forgings, from twenty pounds to twenty-five tons. Crank shafts of all varieties. Erie Forge Company, Erie, Pa.

Inquiry No. 6645.—For manufacturers of advertising folders with following imprint: "Patented by Albert Operti, November 15, 1892." "Copyright 1902 by C. I. Boyer."

We Manufacture on Contract anything in light Hardware. Write us for estimates. Edmonds-Metzel Mfg. Co., 143-153 South Jefferson Street, Chicago.

Inquiry No. 6646.—For manufacturers of tools for making gold wire and shell jewelry.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 6647.—For manufacturers of small steam turbines of ¼ to ½ h. p.

The Scientific American Supplement is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6648.—Wanted, addresses of parties selling grinding machines for grinding lenses, etc.

WANTED.—Colonial silverware. Any one wishing to sell any authentic silver made in this country during the eighteenth century, please communicate with C. A. M., Box 773, New York.

Inquiry No. 6649.—Names and addresses of firms manufacturing spring motors, such as are used for revolving display stands.

Valuable Patent for Sale.—An indispensable article for women. Has large demand in all department stores. Patent No. 774,191. Address Acme Hygienic Co., 132 West 90th Street, New York.

Inquiry No. 6650.—For manufacturers of needle books, containing an assortment of needles; also address of party manufacturing Perfect Dust Beater.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6651.—For manufacturers of asbestos cloth (not paper) or asbestos wearing apparel.

Space with power, heat, light and machinery, if desired, in a large New England manufacturing concern, having more room than is necessary for their business. Address Box No. 407, Providence, R. I.

Inquiry No. 6652.—Wanted, an illustrated price list of ticket-making machines; also firms manufacturing the same.

You can rent a well equipped private laboratory by day, week or month from Electrical Testing Laboratories. 548 East 80th Street, New York. Absolute privacy. Ask for terms and facilities.

Inquiry No. 6653.—For manufacturers of inexpensive mixer which will readily mix light material, including loam and straw, well moistened.

We are prepared to handle all kinds of work in the polishing and buffing line. We employ none but the best of help, and feel warranted in soliciting business in these lines. Rostand Manufacturing Co. New Haven, Conn.

Inquiry No. 6654.—For manufacturers of wind pumps, such as are used for pumping out barges, boats, etc.

TO INVENTORS AND MANUFACTURERS.

Representative of large European electrical concern seeks novelties (technical preferred) for exclusive sale. Buys also patent rights. First-class credentials. Write in strict confidence, stating full particulars, to Patent Abroad, Box 773, New York.

Inquiry No. 6655.—For manufacturers of automatic novelties and mail order specialties of all kinds.

Gut strings for Lawn Tennis, Musical Instruments, and other purposes made by P. F. Turner, 46th Street and Packers Avenue, Chicago, Ill.

Inquiry No. 6656.—For manufacturers of small boxes made of enameled pressed steel or sheet iron.

Inquiry No. 6657.—For manufacturers of window display fixtures; also artistic metal signs.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9565) E. M. H. asks: An empty 10-gallon metal air tank weighs 10 pounds. How much dead weight will be required to sink it in fresh water? Charge the same tank with 100 pounds of air, would it hold up more weight than if not charged? Could you pump the air out of the tank so that it would sink of its own weight? A. A tank of 10 gallons capacity will hold about 1 1-3 cubic feet, and when this is sunk in fresh water it will be buoyed up by a force equal to the weight of 1 1-3 cubic feet of water. This is very nearly 83 1-3 pounds. Since the tank weighs 10 pounds, an addition of 73 1-3 pounds in the tank will sink it. If 100 pounds of air are pumped into the tank, it will sink the same as if 100 pounds of lead were put into the tank. We have now 110 pounds total weight of tank and air, and 83 1-3 pounds buoyant force of water. The difference, or 26 2-3 pounds, will be the force with which it will sink. Pumping air out of the tank will make it lighter, and so it will float better. You cannot make a thing sink by pumping air out of it. Air weighs under ordinary pressure about 1¼ ounces per cubic foot, and 1 1-3 cubic feet will weigh 1 2-3 ounces. The tank will weigh 1 2-3 ounces less when the air is pumped out of it than it did when full of air. You cannot pump 100 pounds of air into such a tank. The pressure would be about 9,000 pounds per square inch, and no tank of this size and weight could withstand any such pressure.

(9566) V. F. asks: 1. Why is the core of induction coil made of small iron wires instead of one solid piece? A The core of an induction coil is made of wire, and not solid, in order to prevent the whirling currents, called "Foucault" currents, which would travel round the core if they could do so. They would heat the core very greatly. 2. Is it the volts, amperes, or watts that make an electromagnet? A. Ampere turns produce magnetism in a coil. One ampere flowing once around a turn of wire is an ampere turn, and the voltage produced by a coil is proportional to the ampere turns in the coil. Hence a coarse wire is used of low resistance, so that there may be a large number of amperes flowing through it, and often many turns are put on, so that the ampere turns may be as great as possible. This applies to the primary winding. 3. Is there any relation between sizes of primary and secondary wires and increase in voltage of an induction coil? Where can I get a book which treats in a simple manner the subject of storage batteries? Also one telling of the process of refining crude petroleum? A. Treadwell's "Storage Batteries," price $1.75, is a good book; Bottone's "Management of Accumulators," price $1.50, is also to be recommended. A good book upon refining petroleum is Brant's "Practical Treatise on Petroleum," price $7.50. 4. It is a law in physics that in the magnetic lines of force, the direction of such lines at any point is a tangent to the curve at that point. What, then, is the direction opposite the middle of a bar magnet? Opposite the end? A. The same rule applies to determine the direction of the magnetic lines when the lines are straight as when they are curved. At the middle of a magnet the tangents coincide with the lines themselves, as they do also at the ends of the magnet. A straight line is a curve with an infinite radius.

(9567) A. W. D. asks: For some time I have been trying to find out what the temperature of the oxyhydrogen flame is, but have been unable to do so. Also, could you tell me if there is any other way, as by the use of a furnace, whereby a person could in the laboratory get a heat equivalent to that of the oxyhydrogen flame? A. The temperature of the oxyhydrogen flame has been variously given by different investigators, from 3,600 deg. Fahr. to 4,400 deg. Fahr. A recent writer gives the latter figure. The temperature of the electric arc is much higher than this, possibly reaching 7,000 deg. Fahr. A valuable book upon this general subject is "High-Temperature Measurements," which we send for $3. The material "thermit" is considered to give a higher temperature than the oxyhydrogen flame.

(9568) W. E. H. asks: What have you on thermo-electricity or thermopiles in book form, not papers? A. There is no book upon thermo-electricity, that is, a book treating only

of this topic. The subject is not large and important enough to call for separate treatment. You will find the mathematical data of thermo-electricity in Everett's "Units and Physical Constants," price $1.25; a good chapter in Watson's "Physics," price $3.50, also in Barker's "Physics," price $3.75. These with occasional papers in the journals include all there is to be had. There are no practical generators of electricity by heat. All which have been brought out are failures and have been retired. Only the thermopile as a measuring instrument is left, and this has only a scientific interest.

(9569) L. L. S. asks: Can you suggest to me something giving comprehensive directions for making a practical electric telephone which will work on a single-wire line (grounded) about three-eighths of a mile long? A. You will find the information you require for making a practical electric telephone in our SUPPLEMENT, No. 966, and SCIENTIFIC AMERICAN, Vol. 72, No. 7. We send these papers for ten cents each. You can operate these instruments over a single wire for a much greater distance than you specify, by grounding the wire at each end of the line, as is done in the telegraph lines.

(9570) C. L. V. asks: Please explain in your Notes and Queries column why a distinct shock is felt when a piece of metal is passed you by another person, in a house which is wired for electric lights. I have noticed this a number of times in this house, but never in any other. A. An electric charge is easily generated in cold, dry weather by walking along a woolen carpet, especially if one scuffs the feet a little on the carpet as he walks. In this way one may light the gas without a match by presenting the tip of a finger to the gas jet. A spark will pass from the finger to the tip of the burner, and a slight shock may be felt. It is obvious that the same shock may be given to another, by reaching out the hand to him. A piece of metal is not needed, nor is it necessary that the house should have electric lights in it. It can be done anywhere in the cold regions, in the cold season.

(9571) E. B. asks: Will you please refer me to some publication or copy of the SCIENTIFIC AMERICAN which will explain the faults of rotary engines that prevent them from coming into general use? A. None of the past numbers of the SCIENTIFIC AMERICAN SUPPLEMENT have articles which explain the faults of rotary engines and their reasons for not going into general use. The great difficulty with a rotary engine is to obtain a simple means of admitting the steam, allowing it to expand to the proper degree and then exhausting it at the right moment, and at the same time preventing leakage past the piston, even after the engine has become somewhat worn. Under ordinary conditions, there is no special advantage of the rotary engine over the ordinary crank and connecting rod, because the loss of efficiency due to the crank and connecting-rod motion is practically zero. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1193, 1158, 1186, and 1309, contain valuable illustrated articles on rotary engines. Price 10 cents each, mailed.

(9572) W. T. M. asks: I am contemplating putting in a little dynamo to light the house which would require about eight lights. I have a water power about 800 feet from the house, consisting of a 6-inch pipe with about 60 pounds per square inch pressure in it, and I would run the dynamo with a water motor of the Pelton type. Now I should like to be able to turn lamps on or out at will, and I am told that I cannot do this with the ordinary type of dynamo without either a governor on the motor or a rheostat in the field circuit. I don't want to bother adjusting a rheostat to every change in the load, and there do not seem to be any water motors on the market with governors small enough for such a light load. Now are there any types of dynamos on the market which can be run by a water motor without a governor and which will maintain a voltage constant enough to do the business? A. We think you are asking the impossible when you ask to run a small dynamo with a small water motor and have it give a constant E. M. F. Even if that could be had, you would not be able to turn lamps on and off without an adjustment of current on the dynamos. A plant cannot be set going and left alone to run itself. The Pelton Water Wheel Company may be able to fit you out with some device for light service, and we would advise you to write them on the subject.

(9573) W. F. H. asks: Will you please answer in the Notes and Queries column of the SCIENTIFIC AMERICAN the following questions: 1. Have wireless telegraph messages been sent across the Atlantic Ocean, and if not, what is the greatest distance over which they have been sent? A. While it is regarded as possible to send messages of words across the Atlantic Ocean by wireless telegraphy, we are not aware that it has ever been done, certainly not commercially. Signals have been believed to be sent across the Atlantic. These consisted of the dots which indicate the letter S in the Morse alphabet. Messages can now be sent to a distance of several hundred miles, and so sent between ships at sea and over the passes in Alaska. 2. Can carbon plates that have been used in dry batteries be used in making new dry batteries? A. Carbon plates are not affected by use in an electric battery, and can be used as long as they last. The black substance in which they are packed requires renewing, but the plates themselves do not need replacing.

(9574) H. A. asks: 1. I separated the two strips of a gold leaf electroscope by electrifying them with a rubbed hard-rubber rod. After that I brought a burning match near them, and observed that the strips fell together again. Did the heat of the flame cause that, and why? A. In the old manner of statement, heated air is a better conductor of electricity than is cold air, and thus the electricity passed off from the gold leaves. The present mode of statement is that the hot air is ionized, and the ions discharge the electroscope. 2. Which is the best way for covering glass with sealing wax, as necessary for instance for the top of a Leyden jar and similar electrical instruments? A. A red varnish may be made for applying to glass by adding vermilion to orange shellac. 3. What book can you recommend me for the study of the radium rays science? A. Rutherford's "Radio-Activity," price $3.50, and Soddy's "Radio-Activity," price $3, are the most recent books upon the subject. 4. I would like to have full description of an electric influence machine (Wimshurst) if possible, with instructions and views for construction. A. You will find full descriptions of Wimshurst and other static machines in Gray's "Electrical Influence Machines," which we send for $2.

(9575) A. R. asks: I have an English pocket altitude barometer, and I am in San Jose at an altitude of 1,135 meters. $1135 \times 3.28 = 3722.80$ feet. Now the barometer shows as 25 inches 3.6 lines, which according with the circle of altitude, corresponds to a height of about 4,550 feet. I get the same result according to Prof. Airey's tables. Please explain what is the matter with them, and how to arrange it. A. The probability is that your barometer is out of adjustment, since it gives an altitude of 4,550 feet, when the true altitude is 3,723 feet, or a little over 800 feet too much. Aneroids require to be set by comparison with a mercurial barometer. They should be compared very often if any dependence is to be placed upon their readings. The United States Weather Bureau does not allow aneroids to be used for observations which are to be made a matter of record in the Bureau. They are not reliable. They are very convenient for travelers, but require frequent correction.

(9576) H. Z. L. says: Which of the pairs of wheels, inner or outer, leave the ground when an automobile turns a sharp corner at high speed, under these conditions: (1) Road level, (2) machine evenly balanced on both sides, (3) corner sharp enough to raise one pair of wheels. This question came up in class, and, as I said that the inner wheels left the ground, if any, I was laughed at by the rest of the class, including the professor. I come to the highest court of appeal, so as to avoid all misunderstandings. A. In the case stated by you of an automobile rounding a curve on a smooth level road, provided the wheels could not skid sideways (which is what generally happens) the machine would be tilted upward on the base of the outer wheels as a fulcrum, thus lifting the inner wheels from the ground. This would happen because centrifugal force acts on the center of gravity of the machine to project it horizontally outward, which it cannot do, as we have presupposed that the wheels cannot skid. Therefore, it must swing the center of gravity about the base of either the inner or outer wheels as a fulcrum. Since the center of gravity of the machine is above the base line of the wheels, and since centrifugal force tends to project it *outward*, it is impossible for said center of gravity to move about the base of the inner wheels as a fulcrum without causing the outer wheels to sink into the ground. Consequently, the base of the outer wheels must act as a fulcrum and the inner wheels be raised in the air, as there is nothing but the force of gravity to prevent them from so doing. In the case of a suspended car, the reverse is true, as there the center of gravity would be below the base line of the wheels, and it could not move centrifugally around the base of the outer wheels as a fulcrum without causing the inner wheels to sink into the track. Consequently, it would have to move about the base of the inner wheels as a fulcrum, and the outer wheels would be raised. In closing, we would advise you not to be too hard on your professor. One mistake is no haystack. And every one makes mistakes sooner or later. Only editors are always right. So spare the poor professor. Be kind to him. You may be one yourself some day if you study hard now, and exercise charity.

(9577) H. F. S. asks: Will you kindly give me the dimensions, or refer me to a book that contains the information, of a small motor suitable for running a ventilating fan? The motor to be of the two-pole type with circular inclosed field magnet; to be run by a battery. A. We have not published the plans for a fan motor of the regular inclosed type, nor do we know any published description from which you could make such a motor to run by a battery. We have, however, in our SUPPLEMENT No. 641 full plans for a motor which will easily drive a fan, sewing machine, or small lathe, and which is driven by a battery. A good battery is described in SUPPLEMENT No. 792. We send these papers for 10 cents each.

(9578) J. V. asks: Will you kindly inform me in Notes and Queries when it is sunrise? Is it when the disk of the sun is first seen above the horizon or when the entire disk is above the horizon? The same would apply also to the setting of the sun. A. The times of sunrise as given in ordinary almanacs are the local mean times when the upper edge or limb of the true sun, as corrected for refraction, is in contact with the sensible horizon of the place, or of any place of equal latitude. This is Todd's definition as given in his "New Astronomy," a valuable book which we can send for $2.

(9579) V. E. M. asks: 1. Two cars start from a power-house on an electric road, the last car using 1-3 of the power; how does the current get to the car ahead after some of it passes through the motor of the first car? Please explain in full. A. The E. M. F. of the trolley feeders is sufficient to provide current for all the cars which will be on a section of the line at one time. Feeders run from the bus bars of the station to the beginnings of the sections of the line, and each feeder enters and supplies current to its own section. If the motors require 500 volts the E. M. F. at the dynamo will be perhaps 10 per cent above that, or 550 volts, to allow for the drop of the line. A booster may be used to keep the pressure at the remote ends of the lines up to the necessary point. As to the particular point about which you ask, how a car ahead gets current when a car behind it is taking current also, there is no difficulty in understanding this if you understand how a house further along the street can get water while you are drawing water in your house from the same main in the street. The main is large enough to supply all the houses which are connected to it, and so is the feeder for a particular section of a trolley line. 2. What is the method of making an Edison Lalande cell (fluid battery)? A. The negative plate of the Edison primary battery is made from copper oxide prepared by compressing it. It cannot be made without heavy presses. The other parts of the cell have no particular method of manufacture, different from making other zinc plates by casting them. The caustic potash is the potash of commerce.

(9580) W. T. J. asks: A person would sit on a chair and two people stand on either side. Then they would all take three deep breaths simultaneously. At the third breath the persons on the sides placed two fingers under the knees and arms of the one in the chair, and while inhaling raised the one in the chair fully five feet off the floor without any effort whatever. This was done to half a dozen different people, and as some of them weighed 150 pounds, it seems impossible to account for it. A. We have stated our view of the feat of lifting a person while inhaling breath or otherwise preoccupied, in answer to Query 8856 in Vol. 88, No. 9, to which we would refer you. As the writer used to lift more than 100 pounds with his little finger when a boy, he does not think it an impossible feat to lift 75 pounds with two fingers of each hand, as is required if two persons lift a man weighing 150 pounds in the manner you describe. The four girls who lift a lady weighing nearly 200 pounds only lift 50 pounds each, and this again is not a very heavy weight for a girl to lift. The preoccupation of the mind by breathing in unison and the intentness upon the effort of lifting at the same instant as the rest enable one to do much more than if not so preoccupied.

(9581) A. R. says: 1. What effect does static electricity have on dynamos? A static electricity will have no effect upon a dynamo unless the discharge is powerful enough to burn out the wiring, as in the case of lightning. 2. How can I tell when there is static electricity in a belt? A. When a belt has an electric charge upon it one may draw sparks from it by holding the fingers toward the belt; or the hair will stand up when one is under the belt. An electroscope will be charged by the belt. 3. What would I need on a switchboard for an isolated plant and connections for same? A. Upon a switchboard are put the switches, ampere meter, and voltmeter, and frequently the field rheostat of the dynamo. The connections of these are made to the places which they are to control. The voltmeter is in shunt with the poles of the dynamo. The ammeter is in series with the line so that all current goes through it. 4. Do the Fire Underwriters require a man to pass an examination and have a license to wire a building? A. The Fire Underwriters do not license men to do electrical work. They simply require that work conform to their rules, or else the insurance is withdrawn. Fire Underwriters are the representatives of the fire insurance companies.

(9582) F. G. C. says: Will you be so kind as to inform me in your Notes and Queries what proportion and how engineers produce in maps the scale 1:30,000? For instance, in a lot of land of 175.50 hectares, how is that scale of 1:30,000 reduced to 175.50 hectares? What is the population in the following nations: Russia (how many inhabitants in Europe and Siberia); Turkey in Europe and Asia; France, England, Italy, Denmark, Holland, Belgium, Prussia, Germany, Austria, China, Corea and Japan, Spain? Could you give us in your valuable SCIENTIFIC AMERICAN a drawing or description of the Port Arthur defenses or fortress? It would be most interesting to subscribers who could judge the tremendous resistance of their heroes. A. If each linear dimension on the land is divided by 30,000 it can then be represented on the map according to the scale you mention. For instance, if the difference between any two points on the ground were 60,000 feet, it would be correctly represented by a distance of two feet on the map. All the distances should be measured on the ground in the same kind of units, either feet or inches, or meters or centimeters, and then the same kind of units that are used in measuring the distances on the ground should be used in laying off the corresponding distances on the map after the division by number representing the proper scale has been performed. The population of the countries and continents you name is as follows:

Europe	393,486,000
Asia	820,768,000
Russia, including Siberia	141,000,000
United Kingdom	80,372,000
Denmark	2,465,000
France	38,962,000
Italy	45,862,000
Holland	5,347,000
Belgium	19,254,000
Germany	58,549,000
Austria	26,151,000
China	407,253,000
Korea	12,000,000
Japan	45,862,000
Spain	18,618,000
Turkey	24,932,000

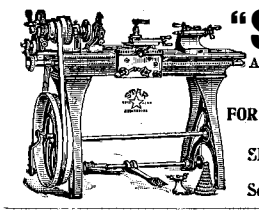
You will find queries of this nature fully answered in our SCIENTIFIC AMERICAN Reference Book, price $1.50. The metric tables are very full. The SCIENTIFIC AMERICAN, January 14, 1905, fully described the Port Arthur defenses.

(9583) J. E. G. asks: If ⅛ cubic inch of rifle powder were confined in a chamber of 1 cubic inch square and ignited, what would the pressure be on each of its six sides? Would the pressure remain any length of time? A. It is impossible to estimate the pressure which would be produced in a rifle chamber if ⅛ of a cubic inch of powder were ignited in a confined space of a cubic inch. A certain quantity of gas would be generated, but the pressure of this gas would depend upon its temperature, and the maximum temperature which is attained in such circumstances depends on the rate of combustion and the character of the chamber in which it is confined; so that it is impossible to form any accurate estimate of it. If the chamber were airtight, the pressure would gradually decrease as the liberated gas cooled. After it was cooled to the temperature of surrounding objects, the temperature would remain constant, and the pressure of the confined gas would then remain constant. It is roughly estimated that gunpowder when burned expands to 2,600 times its original volume. Assuming this figure, the pressure in the problem you give would be about 325 atmospheres, or approximately 4,800 pounds per square inch.

(9584) C. H. asks: 1. I have a quantity of No. 16 copper wire in pieces of from 2 to 5 feet in length; would it do to wind the armatures and field magnet described in SCIENTIFIC AMERICAN SUPPLEMENT No. 641, if the joints were soldered and wrapped with tape? A. If a good soldered joint is made, you can wrap it in tape and use such a wire in winding a field or armature. These joints will, however, be larger than the single wire and will, if there are many of them, cause the winding to be more or less irregular, and unsightly. A neat job cannot be made with splices in the wire. 2. Why is the sodium salt better than the potassium salt for use in a bichromate cell? A. Sodium bichromate is easily dissolved in water, cold or hot. Potassium bichromate requires hot water to dissolve it to sufficient strength for battery use. When sulphuric acid is added to the potassium bichromate solution an alum crystallizes out upon cooling, and crystals are liable to form in the cell also. Neither of these things occurs with the sodium salt. Chromic acid is now to be procured from dealers in chemicals and is to be preferred to either of the bichromates.

(9585) A. G. says: Please tell me what are the chemical formula of: (1) ferric chloride. (2) chromine, and (3) bleaching powder? A. The chemical formula for ferric chloride is $FeCl_3$. Chromine is not a simple chemical compound, but some mixture to which a trade name is given. It is not probable that it is to be found in the market at the present time. Chromic acid is used in batteries now or one of its compounds, either sodium or potassium chromate. Bleaching powder is a substance concerning which a difference of opinion exists among chemists. We follow Remsen's "Chemistry" in giving its formula as $CaOCl_2$.

(9586) W. H. P. asks: I would like to ask through the medium of your Notes and Queries how frozen water pipes are thawed out, by means of electricity, without the use of storage batteries. Is the positive pole of the dynamo connected to one side of the frozen pipe and the negative to the other? If so, why is the dynamo not "short-circuited"? A. Water pipes are thawed by electricity by sending a current of the proper strength through the frozen portion till the water runs. It would not do to throw the current of a dynamo upon a short section of a water pipe. As you say, it would short-circuit the machine.



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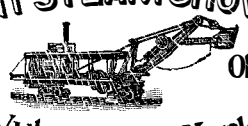

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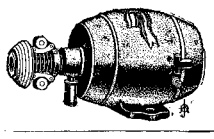

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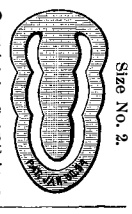

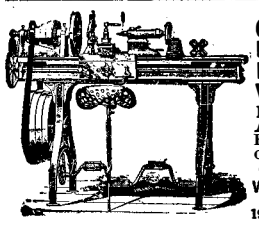

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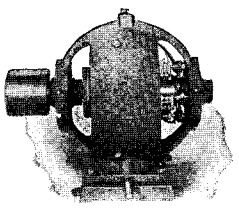

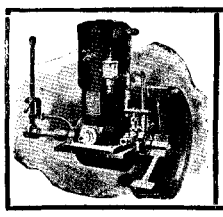

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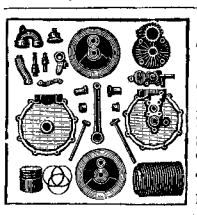

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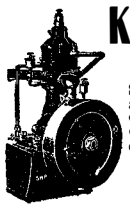

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A rheostat would be necessary for a direct current, and a choke coil or a transformer for the alternating current. We have published the details for the operation, to which we would refer our readers again; they are to be found in the SCIENTIFIC AMERICAN, vol. 90, No. 12, and vol. 92, No. 7, price 10 cents each mailed.

(9587) R. T. P. says: In your SUPPLEMENT of December 3, 1904, page 24,185, you say that if 1,000 pounds water was given a velocity of 16 feet per second, it would lift 1,000 pounds 4 feet high. This you will find in the accompanying paper with sundry calculations. Will you kindly look them over, and if suitable to your paper, I would like to get up a controversy upon what I think may be the nucleus of a new power. A. We are sorry to have to inform you that the assumption on which you have based all your calculations is entirely erroneous, and yet it may be difficult for us to point out to you exactly where your fallacy lies. If you were to pass through the center of a ship a tube, as you suggest, keeping the effective displacement of the ship the same, the added resistance to be overcome by the propeller would be equal to the sum of the work that could be obtained from a turbine placed in this tube, plus all losses in the turbine due to imperfect efficiency, plus the friction of the water on entering the tube and passing through it. The water in the tube will be incapable of doing work unless there is a difference of pressure on the two sides of the turbine. If there is a greater pressure at the front end of the tube, this pressure is created by additional work done by the propeller in forcing the vessel ahead. A better plan than the one you suggest would be to place at the sides of the vessel undershot wheels or paddle wheels, and get useful work from the shaft connecting them. In this instance you can probably see that if the shaft were required to do useful work, and therefore overcome resistance, that the paddle wheels would act as brakes on the side of the vessel to retard its progress, and that whatever retarding force they exerted would have to be made up by the propeller in order to keep the speed of the vessel constant.

(9588) V. O. K. asks: An eighth of an inch of water is put in a shallow dish, a small piece of lighted candle placed in the center, and an inverted tumbler is placed over the candle. Now, I would like to know why the water rushes up into the tumbler after the light has just gone out? A. The heating of the air usually drives some of the air out under the water seal of the glass while the candle is burning, and the products of the combustion do not occupy as much space after as they did before the candle had burned them. The result is that water rises into the glass as the gases cool. We have never seen it *"rush* up," as you express it.

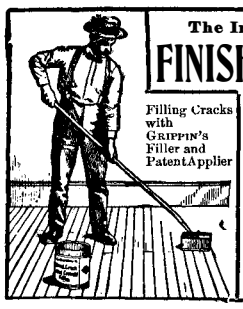
NEW BOOKS, ETC.

ELEMENTS OF MECHANICAL DRAWING. By Gardner C. Anthony. Boston: D. C. Heath & Co., 1905. 16mo.; pp. 152; illustrated. Price, $1.50.

This book forms one of the works of the Technical Drawing series. It is a revised and enlarged edition, intended for use in the evening drawing school and technical college. The first two chapters are given up to instruments and their use and general instruction as to tracing, lettering, shading, tinting, etc. The third chapter contains a large number of geometrical problems. The drawings illustrating these problems are on the same page with the text, where they can be readily examined. The book has no folding plates and all the drawings are condensed as much as possible. Besides chapters on conic sections, orthographic projection, isometric and oblique projection; the development and intersection of surfaces; and spirals, helices, screw-threads, and bolt heads, there are a large number of problems contained in the back of the book, which are intended to be solved by the student after he has mastered the principles in the preceding chapters.

THE CONSTRUCTION OF CRANES AND OTHER LIFTING MACHINES. By Edward C. R. Marks, A.M.I.C.E., M.I.M.E. New York: D. Van Nostrand Company, 1904. 12mo.; pp. 250; 202 half-tone plates and diagrams. Price, $1.50.

This is the third edition, revised and enlarged, of a very useful and complete work on all kinds of lifting machinery. Starting with a description of the general principles and practice in standard types of lifting machines of the smaller kind, such as pulley blocks, crabs, and winches, and double and treble purchase crabs, the author next describes all sorts of cranes from the simplest types worked by hand to the huge and most elaborate types operated by steam or electric power. Another section of the book is devoted to the description of various patented inventions relating to lifting machinery. In this section are given all the latest inventions and improvements in this line. Part III. describes the present practice employed by leading makers of lifting machinery in the construction of hydraulic cranes and jacks, electric locomotive or travel jib cranes, electric walking jib cranes, foundry cranes and winches, electric overhead traveling cranes, Temperley transporters, and electric and hydraulic lifts or elevators and pneumatic hoists. The book is well illustrated with large cuts of the machinery described and with diagrams of the working parts.



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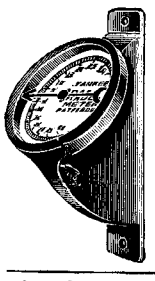

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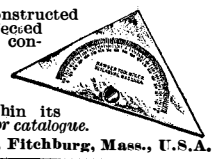

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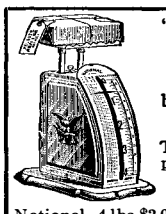

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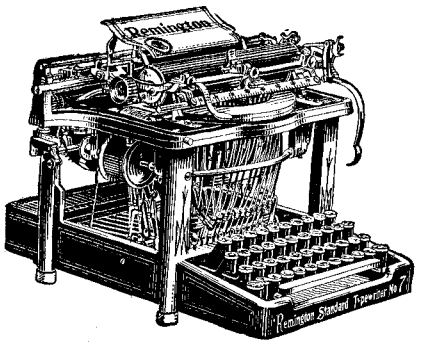

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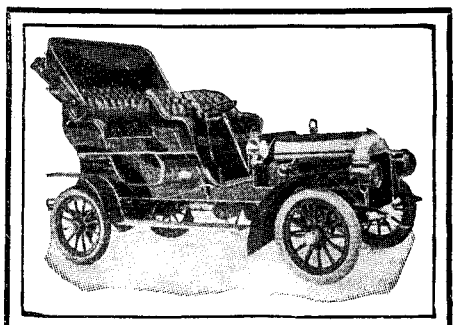

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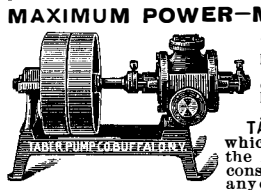

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INKS, THEIR COMPOSITION AND MANUFACTURE. Including Methods of Examination and a Full List of English Patents. By C. Ainsworth Mitchell, B.A. (Oxon.), F.I.C., and T. C. Hepworth. Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 251, 46 illustrations.

This work is a complete handbook on inks and their manufacture. It is divided into three sections, as follows: Writing inks; printing inks; and inks for miscellaneous purposes. The chapters in the first section deal with carbon and carbonaceous inks; tannin materials for inks; the nature of inks; the manufacture of iron-gall inks; logwood, vanadium, and aniline black inks; colored writing inks; and the examination of writing inks. Under printing inks, the early methods of manufacture; the manufacture of varnish; the preparation and incorporation of the pigment; and colored printing inks are described. The last section deals with copying inks; marking inks; safety inks and papers; sympathetic inks; and inks for special purposes. The book is very complete and goes into the subject thoroughly. It contains much information of value to all interested in this subject.

THE TOWER OF PELÉ. By Angelo Heilprin, F.R.G.S., of the Sheffield Scientific School of Yale University. Philadelphia: J. B. Lippincott Company, 1904. 4to.; pp. 62; 22 plates.

Prof. Heilprin has been the chief source of our information regarding the geological changes that have taken place on the island of Martinique for the last few years and to which the attention of the world was first called by the eruption of Mont Pelé in 1902. In 1903 the professor revisited the island, and in this book he describes the middle period in the modern history of Mont Pelé, and shows its condition by numerous photographs reproduced from fine half-tone plates. These plates, of which there are twenty-two, give a complete history of the eruptions and of the devastation wrought by them. The book completes this pictorial description with an up-to-date account of the crater as it now is.

SIMPLE DECORATIVE LATHE WORK. By James Lukin, B.A. London: Guilbert Pitman, 1905. 16mo.; pp. 88; 53 illustrations. Price, 50 cents.

In writing this small volume the author had in view the preparation of a handbook which would enable the amateur, with the aid of inexpensive (and much of it homemade) apparatus, to do simple, ornamental turning of wood, ivory, shells, etc. All the parts of the lathe and the accessories are well described and specific directions are given as to its use. The book is untechnical and will be found very useful to the beginner.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 14, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Advertising apparatus, W. B. Worthy	784,649
Agricultural implement attachment, hand, A. D. Jones	784,682
Air brake, A. J. Wisner	784,910
Air brake deflector, E. Bearss	784,537
Automobile transmission gear, G. A. Thode	784,642
Automobile transmission mechanism, R. H. White	784,607
Awning attachment, automatic, A. I. Senwinger	784,897
Bag holder, J. Riley	784,594
Bag holder and filler, W. H. Stone, Jr.	784,708
Balancing attachment, C. E. Coons	784,924
Baling press, C. J. Luce	785,068
Ball cleaning device, H. D. Day	784,662
Balls, making rubber cored golf, G. C. Worthington	784,648
Balling machine, J. Good	784,853
Barometer, L. F. Chaney	784,986
Basket, R. E. Lindsay	784,950
Basket or other receptacle, J. Hamilton	784,939
Bath tub and attaching feet thereto, J. A. Lefferts	784,746
Bath tub mold, J. P. Bickerstaff	784,913
Battery stem guide, C. F. Hawley	784,790
Bean separating machine, O. F. Beythan	785,032
Bearing, E. S. Farwell	785,036
Beer or other liquid dispensing apparatus, V. E. J. Durafort	784,994
Beet blocking machine, E. J. Young	784,911
Belt guide, J. L. Crisler	784,987
Bench. See Florist's bench.	
Bin, C. T. Ranney	784,887
Binding mechanism, J. A. Plopper	784,702
Blanket, animal, S. D. & E. M. Reid	785,021
Block system, J. W. Anderson, Jr.	785,031
Boiler, J. P. Blauvelt	784,730
Boiler draft regulator, steam, Sackett & Rieger	785,049
Boiler flue cleaner, O. Donatz	784,552
Boiler furnace, S. F. Pierce	784,880
Bolt heading machine, Moore & Holland, 784,624,	784,625
Book holder strap, school, T. E. Barton	784,972
Book support, G. L. T. Denniss	784,734
Bootjack, J. J. McDonald	785,045
Bottle, A. A. Low	785,012
Bottle caps, device for removing internal, F. M. Glaessel	784,851
Bottle holder, nursing, W. J. Boyle	784,914
Bottle mouth and neck, A. A. Low	785,013
Bottle, non-refillable, H. W. Brent, Jr.	784,656
Bottle, non-refillable, F. S. Hefferman	784,941
Bottle, non-refillable, L. N. Bishop	784,975
Bottle soaking machine, Lindemann & Stock	784,622
Bottle stopper, E. Clemens	785,062
Bottle support and protector, J. A. Leu	784,868
Bottling machine, liquid, J. A. Hicks	785,001
Box roller or truck, B. L. Vore	785,029
Braiding machine, B. Kirsch	784,686
Brake beam, J. F. O'Connor	784,698
Brake beam, S. A. Crone	784,839
Breast connector, V. H. Mills	784,800
Brooder, A. F. Meserve	784,954

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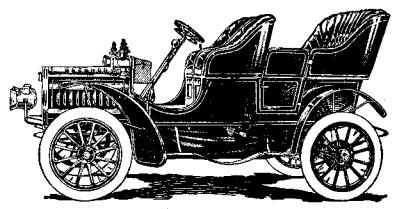

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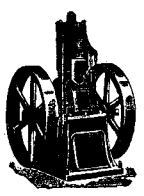

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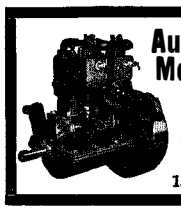

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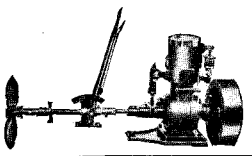

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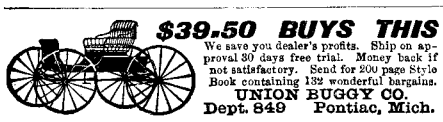

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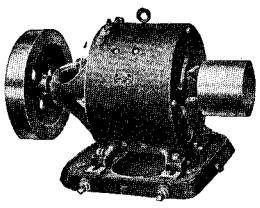

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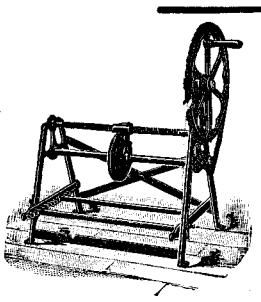

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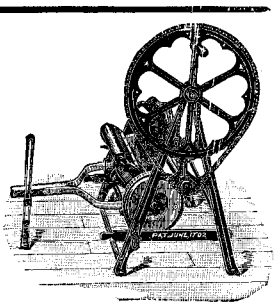

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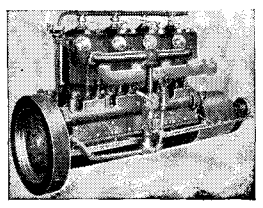

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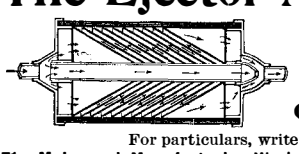

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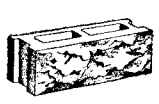

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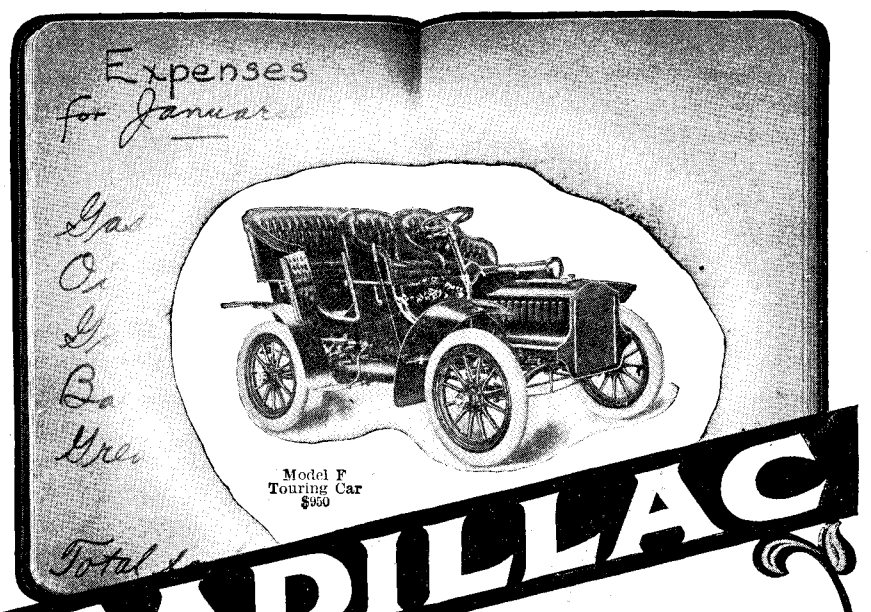
This week it will be found on page 248.

Some week you will be likely to find an inquiry for something that you manufacture or deal in. A prompt reply may bring an order.

Watch it Carefully

Brush, sanitary shaving, Silverman & Vincent	784,763
Bucket, dumping, G. L. Stuebner	784,815
Buckle, H. G. Evans	784,736
Buckle, cross line, H. L. Sheldon	784,810
Buckle, harness, W. Obermeir	784,804
Burglar alarm and trap, H. Maske	785,074
Bushing, rawhide, E. T. Shepard	784,762
Calendar, J. M. Biggs	784,974
Can joints, apparatus for uniendering sheet metal, S. K. Green	784,856
Car brake, L. J. Evans	784,668
Car brake, R. Vogel	784,906
Car coupling, F. G. Smith	784,764
Car coupling, C. A. Tower	784,768
Car coupling, A. Rittersbach	784,889
Car draft rigging, railway, R. M. Zimmerman	784,610
Car draft rigging, railway, J. F. O'Connor	784,697
Car frame, E. I. Dodds	784,665
Car hauling and controlling mechanism, J. G. Scott	784,898
Car, railway, E. A. Trapp	784,817
Car register, F. A. Schierberg	784,595
Car replacer, C. E. Wise	784,647
Car sand box, street, S. W. Phelps	784,879
Car stringer support, C. A. Lindstrom	785,043
Car wheel, J. T. Duff	785,034
Car window sash, street, E. T. Robinson	784,706
Cars, portable loop for dump, Penberthy & Pitchford	784,700
Carbid feeding device, W. Sinclair	784,811
Carbureter, H. D. Studabaker	784,599
Carbureter, gas engine, J. F. & M. Hiltscher	784,676
Carpet cleaning apparatus, A. E. Moorhead	784,801
Carpet fastener, stair, S. Kahn	784,683
Carpet sweeper bails, device for attaching handles to, D. F. Starkweather	785,027
Cartridge, F. H. Rowly	784,977
Carving machine, B. W. Tucker	784,714
Case. See Gun case.	
Chair table, L. Wall	784,604
Cheese cutter, F. P. Dunn	784,553
Chimneys, etc., appliance for use in building, W. T. Weightman	784,606
Chromates, making, R. Suchy	784,640
Circuit breaker, automatic, E. P. Wetmore	784,722
Cistern cleaner and water purifier, T. S. Murray	784,583
Cistern cover, Axt & Borcherding	784,531
Clamping and attaching device, T. Biel	784,654
Clasp, A. G. Kunde	784,573
Clutch, O. S. Beyer	784,653
Clutch sifting device, C. E. Curtiss	784,551
Coal separator, F. H. Emery	784,783
Column, hollow wooden, A. Westerling	784,909
Combination gage, F. J. Stemmrich	784,903
Compressor unloading device, F. W. Parsons	784,961
Computer, lumber, J. E. Chritton	784,660
Condenser, J. M. Keller	784,685
Controlling device, L. S. Walle	784,717
Corkscrew, G. L. Kleiser	784,688
Corn husking apparatus, C. C. Welsh	784,907
Cornice making machine, J. W. Yates, 784,725,	784,726
Cotton, etc., compressing, C. J. Luce	784,579
Cotton picker, J. M. Searles	784,899
Coupling, J. L. Crisler	784,927
Cuff fastener, C. W. Barnes	784,829
Cultivator, S. N. Hench	785,038
Cultivator, riding, P. Jarvis	785,041
Curb, pavement, F. E. Cudell	784,661
Currency for safes, etc., apparatus for marking, A. A. Petersen	784,805
Cuspidor, H. Malick	784,623
Cyanid agitator, E. Stevens	784,598
Damper, P. Fauth	784,997
Dental forceps, I. P. Norton	785,018
Dichlor dimethyl fluorane and making same, P. Julius	785,003
Dispensing apparatus, coin controlled, R. G. Trowbridge	784,905
Displaying advertisements, etc., apparatus for, J. F. Blyth	784,539
Ditching jack, R. Rue	784,890
Door apparatus, revolving, J. A. Pearson	785,047
Door control, pneumatic, C. M. Warner	784,644
Door, doorway, and threshhold for air-tight inclosure, S. P. Stevenson	784,904
Door, hinged lifting, N. C. Schommer	784,896
Door, lifting, N. C. Schommer	784,895
Door securer and alarm combined, D. N. Stewart	784,637
Draft equalizer, J. Dobberstein	784,993
Draft equalizer cushioning device, S. Patzler	785,046
Draw bar, G. Stevenson	785,057
Dredging system, W. H. Le Chard	785,008
Drinking utensil, M. L. Williams	784,970
Driving mechanism, reversing, E. J. Rector	784,705
Edge runner and pan, C. Gielow	784,558
Electric conductor union, F. W. Sorg	784,766
Electric machine, dynamo, H. G. Reist	784,807
Electric machines or motors, brush holder for dynamo, J. F. Card	784,547
Electric motor, Klemm & Reiss	785,004
Electric open switch and stop signal, J. B. Smiley	785,026
Electric solenoid, L. S. Walle	784,718
Electrical conductor junction box, J. Fountain, Jr.	784,555
Electrical distribution system, R. N. Chamberlain	784,732
Electrolysis, apparatus for effecting, H. Philipp	784,592
Electroplating apparatus, H. & C. H. Fleischer	784,617
Elevator control, electric, N. O. Lindstrom	784,869
Engine cylinder, C. Smith	784,636
Engine nozzle, turbine, E. S. Farwell	785,066
Engine sparking igniter, explosive, Hindman & Albright	784,677
Engine speed attachment, gas, Buchner & McClure	784,917
Engines, electric sparking igniter for explosive, G. McCadden	784,626
Excavating machine, J. D. Buchanan	784,980
Excavating machines, etc., movable platform for, F. P., J. D. & A. L. Leach	785,007
Expansion bolt, F. H. Evans	784,845
Explosive engine, revoluble, C. A. Sawtelle	784,808
Eyeglasses, T. H. Pritchard	784,886
Fabric. See Wire fabric.	
Feeder, stock, T. G. Harris	784,940
Feeding device, automatic material, Monahan & Kieren	785,070
Fence post, concrete, R. H. Lathers	784,866
Fence post mold, J. B. Engstrom	784,667
Fence stretcher, M. Reese	784,629
Fencing barb, wire, U. Durand	784,782
Fertilizer distributer, N. A. Butler	784,659
Fifth wheel, M. J. Griffin	784,739
Filing device, C. C. Spengler	784,812
Fire curtains, auxiliary release for theatrical, J. R. Clancy	784,835
Fire escape, F. A. Parker	785,019
Fire escape, portable, D. E. Landis	784,864
Fire sprinkler and alarm system, automatic, Fiddes & Watt	784,669
Firearm magazines, device for indicating the number of cartridges in, F. Gottardi	784,786
Fireproof floor and ceiling construction, A. Pfeiffer	784,878
Fish hook, W. Henckler	784,942
Fisherman's box and life preserver, combined, W. Fisch	784,933
Fishing reel, F. Fullilove	784,671
Fishing spear, J. M. Lobit	784,747
Flat iron cover, A. E. Mattern	785,016
Florist's bench, C. J. Pult	784,756
Flowers, machine for manufacturing artificial, M. L. Beistle	784,912
Flowers, means for preserving and exhibiting, R. R. Spicer	785,055
Fluid distributing system, pneumatic, F. M. Griswold	784,937
Fluid motor, N. A. Palmer	784,591
Fodder shredder, C. C. Welsh	784,908
Food cake, making cattle, M. J. Boutteau	784,778
Force feed lubricator, C. J. Gustafson	784,788
Fuel economizer, F. W. Green	784,560
Furnace, front arch, J. H. Foote	784,737
Gage or gaging tool, A. L. Beardsley	784,652
Game apparatus, D. H. Talbert	784,709
Garment clasp, E. N. Humphrey	784,745
Garment, combination, M. Bunsick	784,918
Garment stretcher, L. Nelson	784,752
Gas, apparatus for the manufacture of water Kramers & Aarts	785,040
Gas burner, C. Nielsen	784,754
Gas burner, acetylene, Kistler & Symonds	784,687
Gas cut off, automatic, J. B. Brown	784,915
Gas engine, Rousseau & Ferris, 784,759,	784,760
Gas generator feeding means, F. E. Guilbaud	784,740



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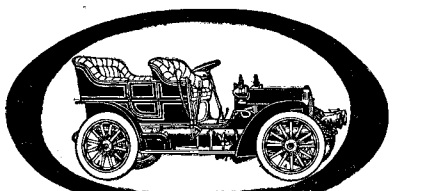

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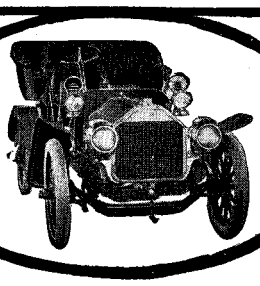

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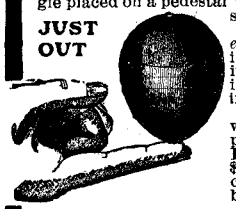

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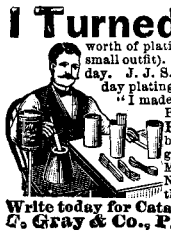

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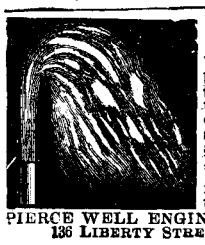

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Locking bar pipe, G. J. Hoskins	784,566
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Loom shuttle, hand threading, C. E. Sackett	784,761
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Loom warp stop motion, C. E. Chase	784,920
Looping and tying machine, Miller & Gilmore	784,749
Lubricator, D. R. MacBain	784,953
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Massage apparatus, E. W. Schneider	784,809
Massage machine, G. F. Trotter	784,643
Mat, R. L. Horsley	784,564
Measuring tape holder, W. J. Seep	785,052
Metal treating furnace, J. Morat	784,956
Metals from ore by electricity, extracting, E. L. Priest	784,885
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Meters, electric central station recording mechanism for, C. H. Thordarson	784,712
Milking apparatus, W. H. Lawrence	784,796
Milking machine, F. Ljungstrom	784,693
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Mold, J. B. Petrie	784,701
Mold, C. Miller	784,874
Mold, O. A. Stempel	784,967
Mold coating apparatus, Merrits & Bartlebaugh	784,873
Molding machine, H. A. Battenfeld	784,535
Molding machine, J. N. & H. A. Battenfeld	784,536
Molding machine, adjustable, I. L. Landis	784,690
Mower, S. K. Dennis	784,663
Muff, W. Grushoff	784,857
Muffler, A. P. Brush	784,833
Musical wind instrument, Wiser & Walcott	784,608
Nailing machine, J. H. Greenstreet	784,936
Needle case, P. A. Curtin	784,841
Numbering machine, E. G. Bates	784,729
Nut lock, H. Schuette	784,634
Nut lock, A. A. Long	784,951
Oil can holder, F. H. Spicer	785,054
Oil elevator, P. H. Davitt	784,991
Onion cleaner, F. Griffis	784,618
Ore roasting furnace, H. M. Heath et al	785,067
Oven, toasting, R. Grace	784,854
Overalls, M. Colstrom	784,615
Packing machine, D. L. Eustice	784,932
Packing, rod, C. R. Law	784,867
Packing, shaft, F. E. Getts	784,785
Pad. See Ink pad.	
Pan and stove lid lifter, combined, A. M. Moylan	784,803
Paper drying cylinders, apparatus for removing water from, J. White	784,821
Paper hanging device, wall, C. F. Caswell	784,985
Pen filling device, fountain, G. N. Byl	784,982
Pen, fountain, T. P. Ambrose	784,528
Pen, fountain, F. W. Bender	784,538
Phonograph, L. Devineau	784,603
Photographic exposure meter, C. W. Dake	784,988
Photographic print washing apparatus, E. L. Johnson	784,861
Photographic printing apparatus, H. H. McIntire	784,587
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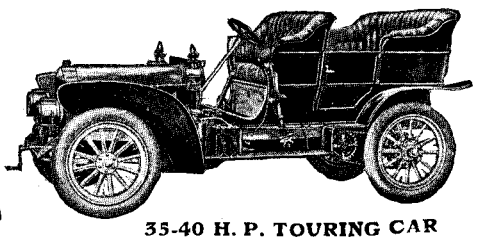

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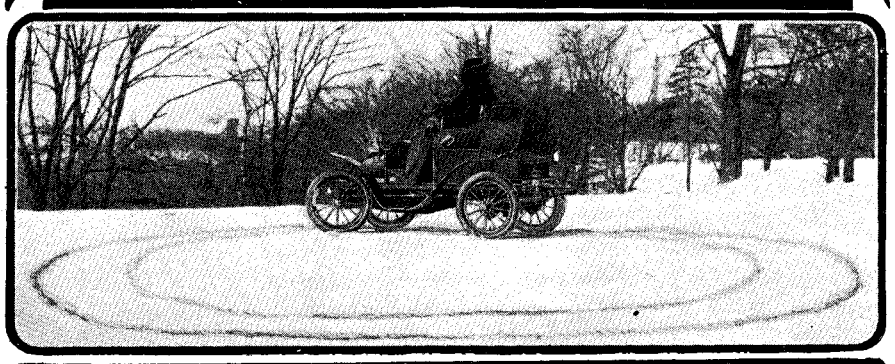

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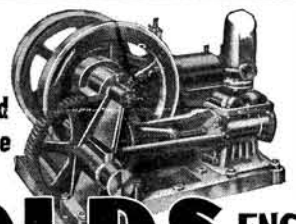

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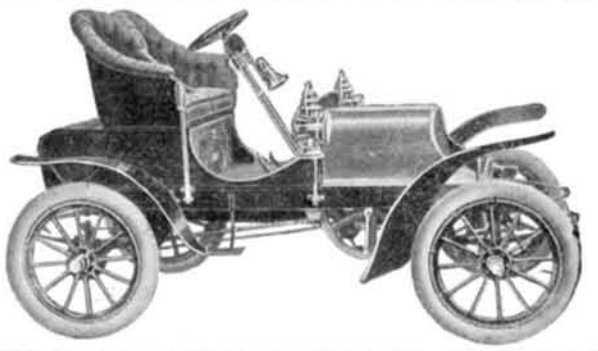

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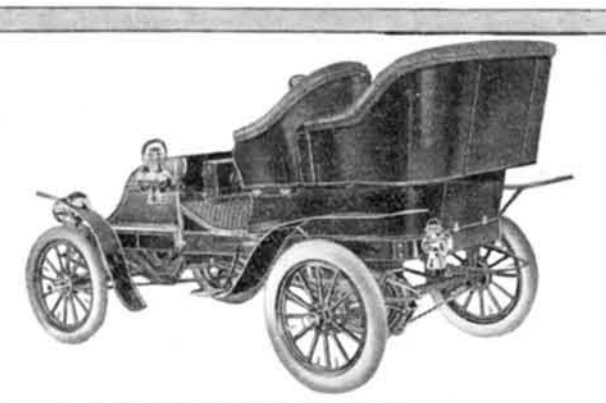

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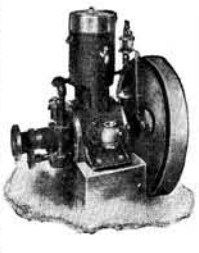

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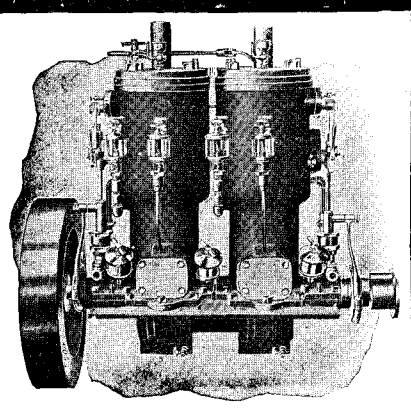

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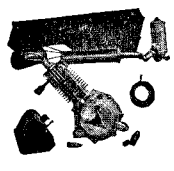

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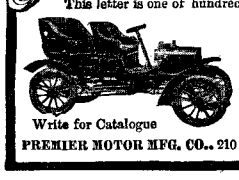

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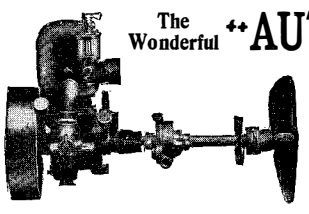

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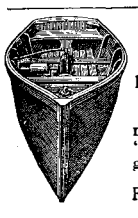

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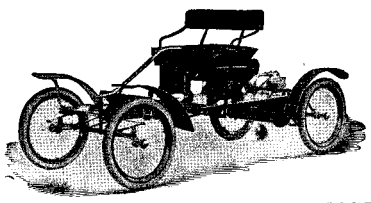

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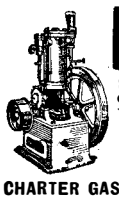

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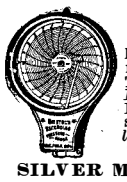

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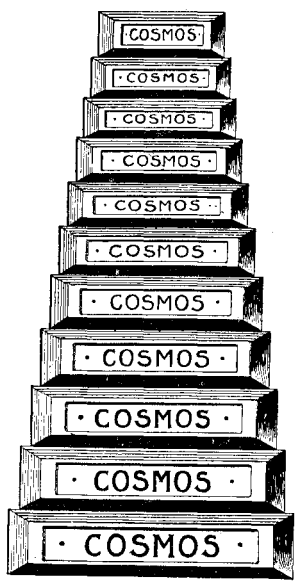

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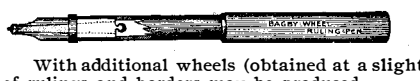

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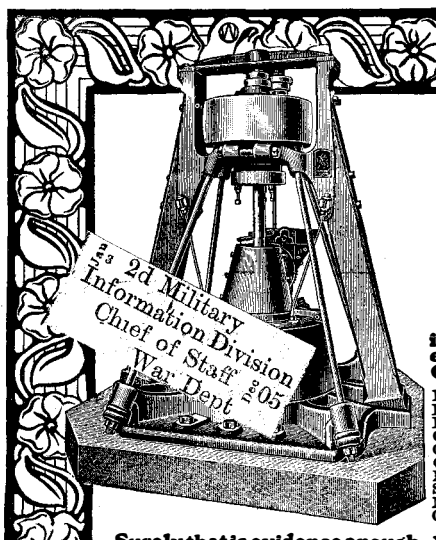

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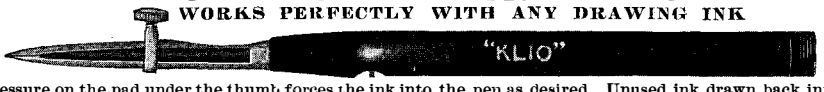

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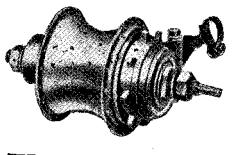

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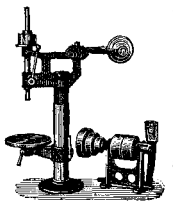

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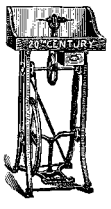

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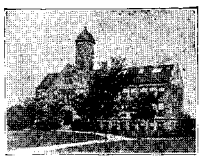

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